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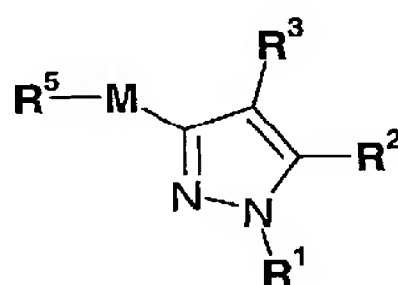
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(54) Title: **CHEMICAL COMPOUNDS**



(I)

(57) Abstract: The invention relates to a group of novel pyrazole compounds of Formula (I): wherein: R¹, R², R³, M and R⁵ are as defined in the specification, which are useful as gonadotrophin releasing hormone antagonists. The invention also relates to pharmaceutical formulations of said compounds, methods of treatment using said compounds and to processes for the preparation of said compounds.



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CHEMICAL COMPOUNDS

The present invention relates to compounds which are antagonists of gonadotropin releasing hormone (GnRH) activity. The invention also relates to pharmaceutical formulations, the use of a compound of the present invention in the manufacture of a
5 medicament, a method of therapeutic treatment using such a compound and processes for producing the compounds.

Gonadotropin releasing hormone (GnRH) is a decapeptide that is secreted by the hypothalamus into the hypophyseal portal circulation in response to neural and/or chemical stimuli, causing the biosynthesis and release of luteinizing hormone (LH) and follicle-
10 stimulating hormone (FSH) by the pituitary. GnRH is also known by other names, including gonadoliberein, LH releasing hormone (LHRH), FSH releasing hormone (FSH RH) and LH/FSH releasing factor (LH/FSH RF).

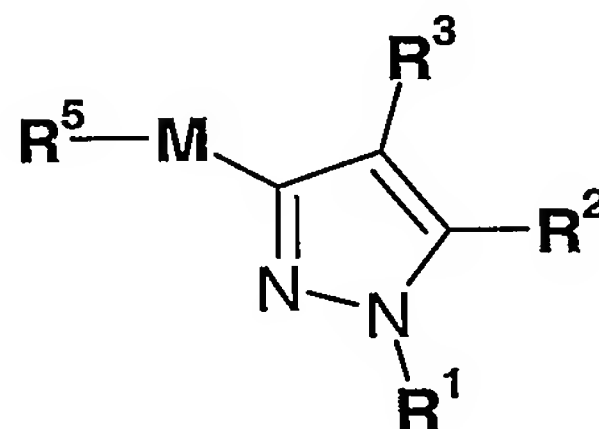
GnRH plays an important role in regulating the action of LH and FSH (by regulation of their levels), and thus has a role in regulating the levels of gonadal steroids in both sexes,
15 including the sex hormones progesterone, oestrogens and androgens. More discussion of GnRH can be found in WO 98/5519 and WO 97/14697, the disclosures of which are incorporated herein by reference.

It is believed that several diseases would benefit from the regulation of GnRH activity, in particular by antagonising such activity. These include sex hormone related conditions
20 such as sex hormone dependent cancer, benign prostatic hypertrophy and myoma of the uterus. Examples of sex hormone dependent cancers are prostatic cancer, uterine cancer, breast cancer and pituitary gonadotrophe adenoma.

The following disclose compounds purported to act as GnRH antagonists:
WO 97/21435, WO 97/21703, WO 97/21704, WO 97/21707, WO 55116, WO 98/55119, WO
25 98/55123, WO 98/55470, WO 98/55479, WO 99/21553, WO 99/21557, WO 99/41251, WO 99/41252, WO 00/04013, WO 00/69433, WO 99/51231, WO 99/51232, WO 99/51233, WO 99/51234, WO 99/51595, WO 99/51596, WO 00/53178, WO 00/53180, WO 00/53179, WO 00/53181, WO 00/53185, WO 00/53602, WO 02/066477, WO 02/066478, WO 02/06645 and WO 02/092565.

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It would be desirable to provide further compounds, such compounds being GnRH antagonists. Thus, according to the first aspect of the invention there is provided a compound of Formula (I),

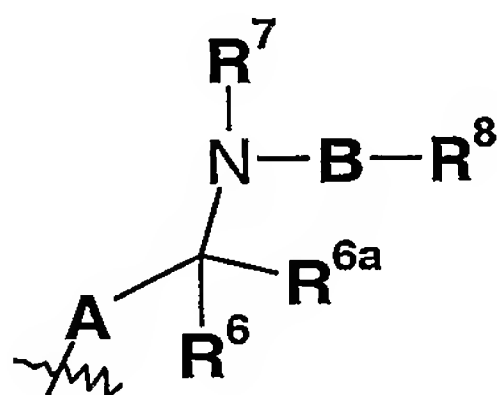


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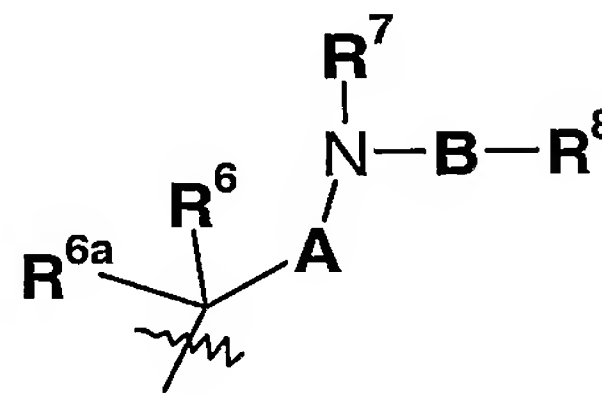
Formula (I)

wherein:

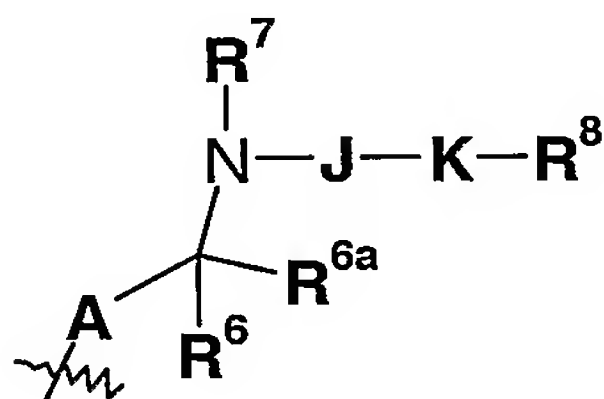
- R^1 is selected from: hydrogen, optionally-substituted C_{1-6} alkyl, optionally substituted aryl or optionally-substituted aryl C_{1-6} alkyl;
- 10 R^2 is an optionally-substituted mono or bi-cyclic aromatic ring;
- R^3 is selected from a group of Formula (IIa) to Formula (IIf):



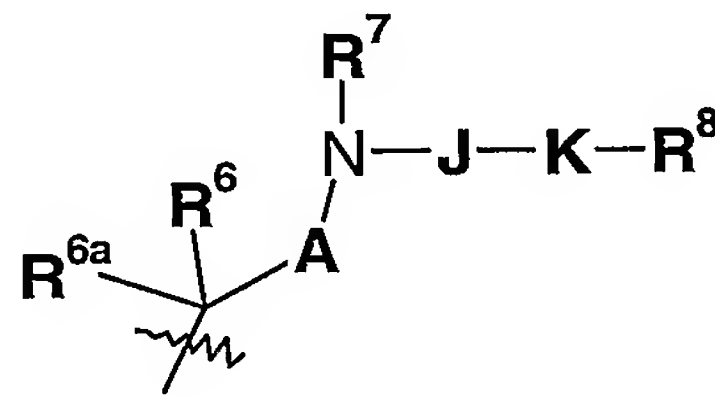
Formula (IIa)



Formula (IIb)

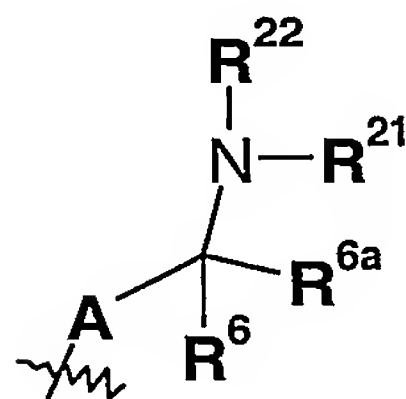


Formula (IIc)

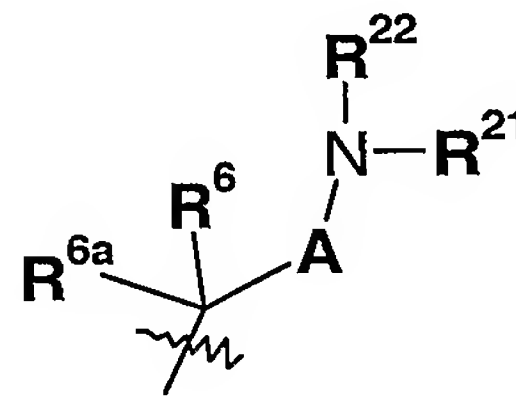


Formula (IId)

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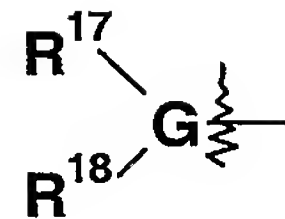
Formula (IIe)



Formula (IIf)

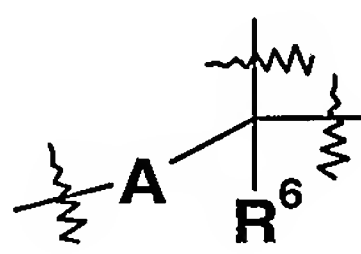
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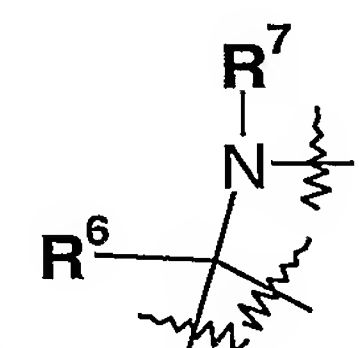
R^5 is a group of Formula (III):



Formula (III)

- R^6 and R^{6a} are independently selected from hydrogen, fluoro, optionally substituted C_{1-6} alkyl, optionally-substituted aryl or optionally substituted aryl C_{1-6} alkyl, or R^6 and R^{6a} taken together and the carbon atom to which they are attached form a carbocyclic ring of 3-7 atoms, or R^6 and R^{6a} taken together and the carbon atom to which they are attached form a carbonyl group;

- or when **A** is not a direct bond the group  forms a carbocyclic ring of 3-7 carbon atoms or a heterocyclic ring containing one or more heteroatoms;

- or the group  forms a heterocyclic ring containing 3-7 carbon atoms and one or more heteroatoms;

- R^7 is selected from: hydrogen, optionally-substituted C_{1-6} alkyl, optionally-substituted aryl C_{1-6} alkyl, optionally-substituted aryl, optionally substituted heterocyclyl, optionally substituted heterocyclyl C_{1-6} alkyl, R^9OC_{1-6} alkyl-, $R^9R^{10}NC_{1-6}$ alkyl-, $R^9R^{10}NC(O)C_{1-6}$ alkyl, $-C(NR^9R^{10})=NH$;

or when R^3 is a group of Formula (IIc) or (IId) R^7 is of the formula $-J-K-R^8$;

R^8 is selected from:

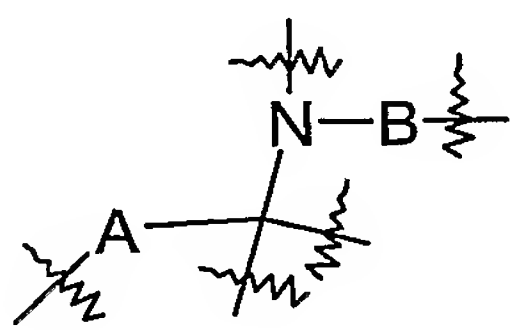
- (i) hydrogen, C_{1-6} alkyl, C_{2-6} alkenyl, C_{2-6} alkynyl, halo C_{1-6} alkyl, C_{1-4} alkoxy C_{1-4} alkyl, hydroxy, hydroxy C_{1-6} alkyl, cyano, N- C_{1-4} alkylamino, N,N-di- C_{1-4} alkylamino, C_{1-6} alkyl-S(O_n)-, $-O-R^b$, $-NR^bR^c$, $-C(O)-R^b$, $-C(O)O-R^b$, $-CONR^bR^c$, $NH-C(O)-R^b$ or $-S(O_n)NR^bR^c$, where R^b and R^c are independently selected from hydrogen and C_{1-4} alkyl optionally substituted with hydroxy, amino, N- C_{1-4} alkylamino, N,N-di- C_{1-4} alkylamino, HO- C_{2-4} alkyl-NH- or HO- C_{2-4} alkyl-N(C_{1-4} alkyl)-;
- (ii) nitro when **B** is a group of Formula (IV) and **X** is CH and **p** is 0;

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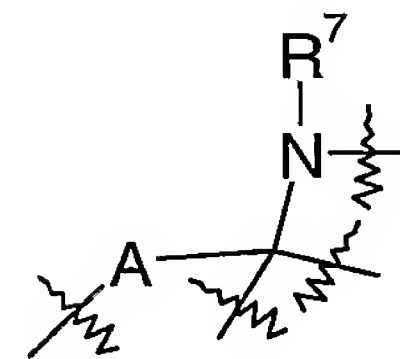
- (iii) C₃₋₇cycloalkyl, aryl or arylC₁₋₆alkyl each of which is optionally substituted by **R**¹², **R**¹³ and **R**¹⁴;
- (iv) -(**Q**)-aryl, -(**Q**)-heterocyclyl, -aryl-(**Q**)-aryl, each of which is optionally substituted by **R**¹², **R**¹³ and **R**¹⁴
- 5 wherein -(**Q**)- is selected from **E**, **F** or a direct bond;
- (v) heterocyclyl or heterocyclylC₁₋₆alkyl each of which is optionally substituted by up to 4 substituents independently selected from **R**¹², **R**¹³ and **R**¹⁴;
- (vi) a group selected from **R**¹², **R**¹³ and **R**¹⁴;
- R**⁹ and **R**¹⁰ are independently selected from: hydrogen, hydroxy, optionally substituted
- 10 C₁₋₆alkyl, optionally substituted aryl, optionally substituted arylC₁₋₆alkyl, an optionally substituted carbocyclic ring of 3-7 atoms, optionally substituted heterocyclyl, optionally substituted heterocyclylC₁₋₆alkyl or **R**⁹ and **R**¹⁰ taken together can form an optionally substituted ring of 3-9 atoms or **R**⁹ and **R**¹⁰ taken together with the carbon atom to which they are attached form a carbonyl group;
- 15 **R**¹¹ is selected from: hydrogen, optionally substituted C₁₋₆alkyl, or N(**R**⁹**R**¹⁰);
- R**¹² is selected from: hydrogen, hydroxy, **R**¹⁷**R**¹⁸N(CH₂)_{cc}-, **R**¹⁷**R**¹⁸NC(O)(CH₂)_{cc}-, optionally substituted C₁₋₆alkyl- C(O)N(**R**⁹)(CH₂)_{cc}-, optionally substituted C₁₋₆alkyl-SO₂N(**R**⁹)-, optionally substituted aryl-SO₂N(**R**⁹)-, C₁₋₃perfluoroalkyl-SO₂N(**R**⁹)-; optionally substituted C₁₋₆alkyl-N(**R**⁹)SO₂-, optionally substituted aryl-N(**R**⁹)SO₂-, C₁₋₃perfluoroalkyl-N(**R**⁹)SO₂- optionally substituted C₁₋₆alkanoyl-N(**R**⁹)SO₂-, optionally substituted aryl-C(O)N(**R**⁹)SO₂-, optionally substituted C₁₋₆alkyl-S(O_n) -, optionally substituted aryl-S(O_n) -, C₁₋₃perfluoroalkyl-, C₁₋₃perfluoroalkoxy, optionally substituted C₁₋₆alkoxy, carboxy, halo, nitro or cyano;
- 20 **R**¹³ and **R**¹⁴ are independently selected from: hydrogen, hydroxy, oxo, optionally substituted C₁₋₆alkyl, optionally substituted C₁₋₆alkanoyl, optionally substituted C₂₋₆alkenyl, cyano, nitro, C₁₋₃perfluoroalkyl-, C₁₋₃perfluoroalkoxy, optionally substituted aryl, optionally substituted arylC₁₋₆alkyl, **R**⁹O(CH₂)_s-, **R**⁹(O)O(CH₂)_s-, **R**⁹OC(O)(CH₂)_s-, **R**¹⁶S(O_n)(CH₂)_s-, **R**⁹**R**¹⁰NC(O)(CH₂)_s- or halo;
- 25 **R**¹⁵ is selected from: hydrogen, optionally substituted C₁₋₆alkyl, **R**¹⁹OC(O)-, **R**⁹**R**¹⁰NC(O)-, **R**⁹C(O)-, **R**⁹S(O_n)-;
- 30 **R**¹⁶ is selected from: hydrogen, C₁₋₆alkyl, C₁₋₃perfluoroalkyl or optionally-substituted aryl;
- R**¹⁷ is independently selected from: hydrogen, hydroxy, cyano or optionally substituted C₁₋₆alkyl;

- 5 -

- R^{18} is a group of formula $R^{18a}-C(R^9R^{10})_{0-1}$ - wherein R^{18a} is selected from: $R^{19}OC(O)-$, $R^9R^{10}NC(O)-$, $R^9R^{10}N-$, $R^9C(O)-$, $R^9C(O)N(R^{10})-$, $R^9R^{10}NC(O)-$, $R^9R^{10}NC(O)N(R^{10})-$, $R^9SO_2N(R^{10})-$, $R^9R^{10}NSO_2N(R^{10})-$, $R^9C(O)O-$, $R^9OC(O)-$, $R^9R^{10}NC(O)O-$, R^9O- , $R^9S(O_n)-$, $R^9R^{10}NS(O_n)-$, hydrogen, optionally substituted C_{1-6} alkyl, optionally substituted heterocyclyl;
- or R^{17} and R^{18} when taken together form an optionally substituted carbocyclic ring of 3-7 atoms or optionally substituted heterocyclyl;
- R^{19} is selected from: hydrogen, optionally substituted C_{1-6} alkyl, optionally substituted aryl, optionally substituted aryl C_{1-6} alkyl, optionally substituted C_{3-7} cycloalkyl, optionally substituted heterocyclyl or optionally substituted heterocyclyl C_{1-6} alkyl;
- R^{21} and R^{22} are independently selected from hydrogen, optionally substituted C_{1-6} alkyl, optionally substituted C_{3-7} cycloalkyl, optionally substituted heterocyclyl, optionally substituted heterocyclyl C_{1-6} alkyl, optionally substituted C_{3-6} alkenyl, optionally substituted C_{3-6} alkynyl, $-(C_{1-5}alkyl)_{aa}-S(O_n)-(C_{1-5}alkyl)_{bb}-$; $R^9R^{10}NC_{2-6}alkyl$, $R^9OC_{2-6}alkyl$ or $R^9R^{10}NC(O)C_{2-6}alkyl$, with the proviso that R^9 and R^{10} independently or taken together are not optionally substituted aryl or optionally substituted aryl C_{1-6} alkyl; or
- R^{21} and R^{22} taken together form an optionally substituted non-aromatic heterocyclic ring;
- A is selected from:
- (i) a direct bond;
 - (ii) optionally-substituted C_{1-5} alkylene wherein the optional substituents are independently selected from: optionally-substituted C_{1-6} alkyl, optionally-substituted aryl or optionally substituted aryl C_{1-6} alkyl;
 - (iii) a carbocyclic ring of 3-7 atoms;
 - (iv) a carbonyl group or $-C(O)-C(R^dR^d)-$, wherein R^d is independently selected from hydrogen and C_{1-2} alkyl;

or when R^3 is a group of Formula (IIa) or (IIb), the group  forms a heterocyclic ring containing 3-7 carbon atoms and one or more heteroatoms;

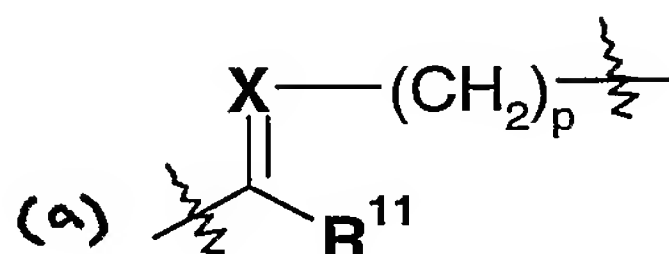
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or when R^3 is a group of Formula (IIa), (IIb), (IIc) or (IIId), the group forms a heterocyclic ring containing 3-7 carbon atoms and one or more heteroatoms;

B is selected from:

- (i) a direct bond;
 5 (ii) a group of Formula (IV)



Formula (IV)

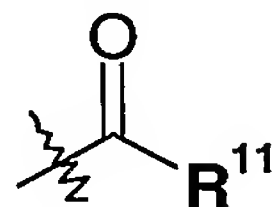
wherein:

X is selected from N or CH,

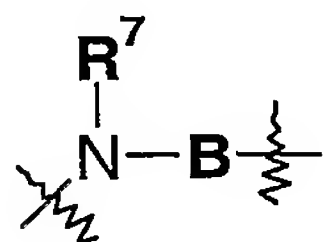
- 10 wherein at position (a) Formula (IV) is attached to the nitrogen atom and the $(CH_2)_p$ group is attached to R^8 ; and

- (iii) a group independently selected from: optionally substituted C_{1-6} alkylene, optionally substituted C_{3-7} cycloalkyl, optionally substituted C_{3-6} alkenylene, optionally substituted C_{3-6} alkynyl, C_{1-6} alkoxy, $(C_{1-5}alkyl)_{aa}-S(O_n)-(C_{1-5}alkyl)_{bb}-$,
 15 $-(C_{1-5}alkyl)_{aa}-O-(C_{1-5}alkyl)_{bb}-$, $-(C_{1-5}alkyl)_{aa}-C(O)-(C_{1-5}alkyl)_{bb}-$ or $(C_{1-5}alkyl)_{aa}-N(R^{15})-(C_{1-5}alkyl)_{bb}$,
 wherein R^{15} and the $(C_{1-5}alkyl)_{aa}$ or $(C_{1-5}alkyl)_{bb}$ chain can be joined to form a ring, wherein the combined length of $(C_{1-5}alkyl)_{aa}$ and $(C_{1-5}alkyl)_{bb}$ is less than or equal to C_5 alkyl;

- 20 or the group $-B-R^8$ represents a group of Formula (V)

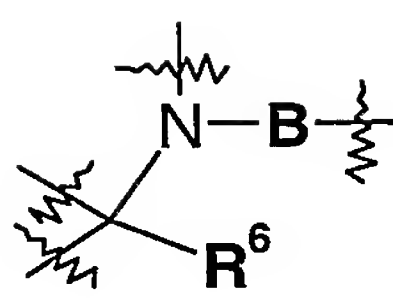


Formula (V);



or the group together forms an optionally substituted heterocyclic ring containing 4-7 carbon atoms;

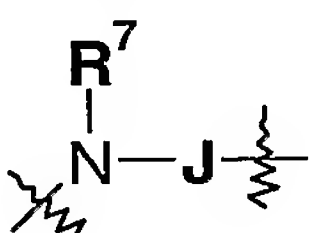
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or the group  forms a heterocyclic ring containing 3-7 carbon atoms and one or more heteroatoms;

E is $-\text{O}-$, $-\text{S}(\text{O}_n)-$, $-\text{C}(\text{O})-$, $-\text{NR}^{15}-$ or $-\text{C}(\text{R}^9\text{R}^{10})_q-$;

F is $-\text{E}(\text{CH}_2)_r-$;

- 5 **G** is selected from: hydrogen, halo, N, O, $\text{S}(\text{O}_n)$, $\text{C}(\text{O})$, $\text{C}(\text{R}^9\text{R}^{10})_t$, optionally substituted C_{2-6} alkenylene, optionally substituted C_{2-6} alkynylene or a direct bond to R^{18} ,
J is a group of the formula: $-(\text{CH}_2)_s-\text{L}-(\text{CH}_2)_s-$ wherein when s is greater than 0, the alkylene group is optionally substituted,

or the group  together forms an optionally substituted heterocyclic ring

- 10 containing 4-7 carbons atoms;

K is selected from: a direct bond, $-(\text{CH}_2)_{s1}-$, $-(\text{CH}_2)_{s1}-\text{O}-(\text{CH}_2)_{s2}-$, $-(\text{CH}_2)_{s1}-\text{C}(\text{O})-(\text{CH}_2)_{s2}-$,
 $-(\text{CH}_2)_{s1}-\text{S}(\text{O}_n)-(\text{CH}_2)_{s2}-$, $-(\text{CH}_2)_{s1}-\text{N}(\text{R}^{18})-(\text{CH}_2)_{s2}-$, $-(\text{CH}_2)_{s1}-\text{C}(\text{O})\text{N}(\text{R}^9)-(\text{CH}_2)_{s2}-$,
 $-(\text{CH}_2)_{s1}-\text{N}(\text{R}^9)\text{C}(\text{O})-(\text{CH}_2)_{s2}-$, $-(\text{CH}_2)_{s1}-\text{N}(\text{R}^9)\text{C}(\text{O})\text{N}(\text{R}^9)-(\text{CH}_2)_{s2}-$,
 $-(\text{CH}_2)_{s1}-\text{OC}(\text{O})-(\text{CH}_2)_{s2}-$, $-(\text{CH}_2)_{s1}-\text{C}(\text{O})\text{O}-(\text{CH}_2)_{s2}-$, $-(\text{CH}_2)_{s1}-\text{N}(\text{R}^9)\text{C}(\text{O})\text{O}-(\text{CH}_2)_{s2}-$,
15 $-(\text{CH}_2)_{s1}-\text{OC}(\text{O})\text{N}(\text{R}^9)-(\text{CH}_2)_{s2}-$, $-(\text{CH}_2)_{s1}-\text{OS}(\text{O}_n)-(\text{CH}_2)_{s2}-$, or
 $-(\text{CH}_2)_{s1}-\text{S}(\text{O}_n)-\text{O}-(\text{CH}_2)_{s2}-$, $-(\text{CH}_2)_{s1}-\text{S}(\text{O})_2\text{N}(\text{R}^9)-(\text{CH}_2)_{s2}-$ or
 $-(\text{CH}_2)_{s1}-\text{N}(\text{R}^9)\text{S}(\text{O})_2-(\text{CH}_2)_{s2}-$; wherein the $-(\text{CH}_2)_{s1}-$ and $-(\text{CH}_2)_{s2}-$ groups are independently optionally substituted by hydroxy or C_{1-4} alkyl;

L is selected from optionally substituted aryl or optionally substituted heterocyclyl;

- 20 **M** is selected from $-(\text{CH}_2)_{0-2}-\text{O}-$ or $-\text{C}(\text{O})\text{NH}-$;

n is an integer from 0 to 2;

p is an integer from 0 to 4;

q is an integer from 0 to 4;

r is an integer from 0 to 4;

- 25 **s** is an integer from 0 to 4;

s1 and **s2** are independently selected from an integer from 0 to 4, and

s1+s2 is less than or equal to 4;

t is an integer between 0 and 4; and

aa and **bb** are independently 0 or 1;

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cc is an integer between 0 to 2;

with the proviso that

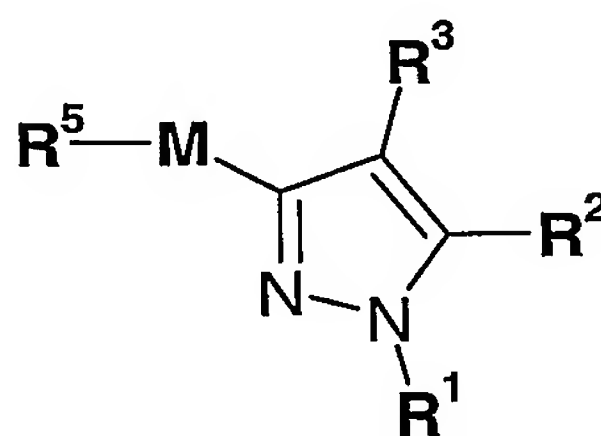
- (i) when **G** is hydrogen or halo, then **R**¹⁷ and **R**¹⁸ are both absent;
- (ii) when **G** is O, S(O_n), C(O) or C(**R**¹¹**R**¹²)_t then **G** is substituted by a single group independently selected from the definition of **R**¹⁷ or **R**¹⁸ and when **G** is a direct bond to **R**¹⁸ then **G** is substituted by a single group selected from **R**¹⁸;
- (iii) when **R**³ is a group of Formula (IIb), **B** is a group of Formula (IV), **R**⁸ is selected from group (i) or (ii) above, **R**¹¹ is a group of the formula N(**R**¹⁰**R**¹¹) and **R**¹, **R**² and **R**⁵ are as defined above then **R**⁴ cannot be hydrogen;
- (iv) **R**³ cannot be unsubstituted pyridyl or unsubstituted pyrimidinyl; and
- (v) when **R**³ is pyrazolyl substituted by phenyl or pyrazolyl substituted by phenyl and acetyl, **R**⁵-**M** is hydroxyl or acetyloxy, **R**² is unsubstituted phenyl, then **R**¹ cannot be hydrogen or acetyl;

or a salt, solvate or pro-drug thereof.

- 15 According to the further feature of the first aspect of the invention there is provided a compound of Formula (I) with the proviso that

- (i) when **G** is hydrogen or halo, then **R**¹⁷ and **R**¹⁸ are both absent;
 - (ii) when **G** is O, S(O_n), C(O) or C(**R**¹¹**R**¹²)_t then **G** is substituted by a single group independently selected from the definition of **R**¹⁷ or **R**¹⁸ and when **G** is a direct bond to **R**¹⁸ then **G** is substituted by a single group selected from **R**¹⁸;
 - (iii) when **R**³ is a group of Formula (IIb), **B** is a group of Formula (IV), **R**⁸ is selected from group (i) or (ii) above, **R**¹¹ is a group of the formula N(**R**¹⁰**R**¹¹) and **R**¹, **R**² and **R**⁵ are as defined above then **R**⁴ cannot be hydrogen; and
 - (iv) **R**³ cannot be an unsubstituted or substituted aromatic heterocyclic ring, wherein the aromatic heterocyclic ring is attached directed to the pyrazole in Formula (I);
- or a salt, solvate or pro-drug thereof.

According to the further feature of the first aspect of the invention there is provided a compound of Formula (Ia),



Formula (Ia)

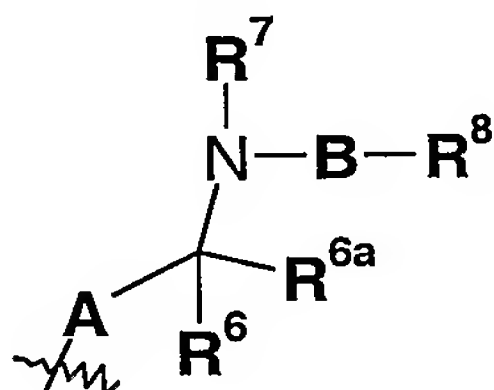
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wherein:

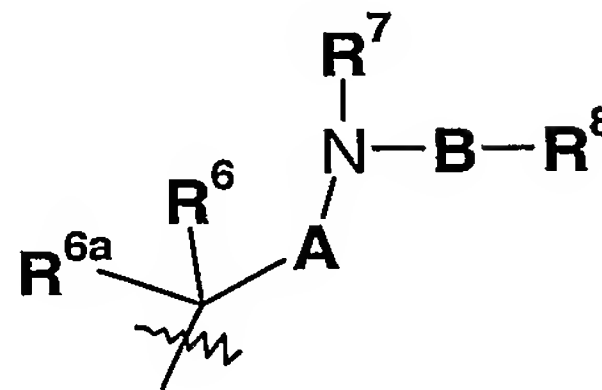
R^1 is selected from: hydrogen, optionally-substituted C_{1-6} alkyl, optionally substituted aryl or optionally-substituted aryl C_{1-6} alkyl;

R^2 is an optionally-substituted mono or bi-cyclic aromatic ring;

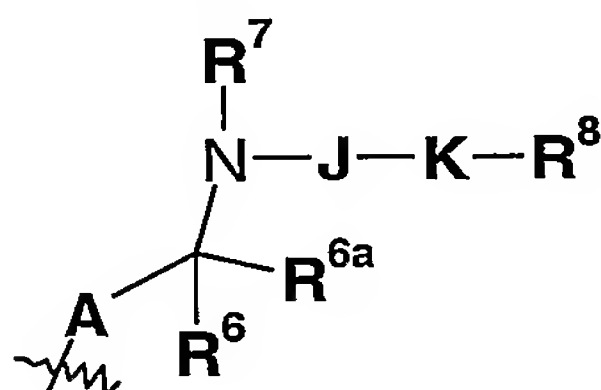
5 R^3 is selected from a group of Formula (IIa) to Formula (IIf):



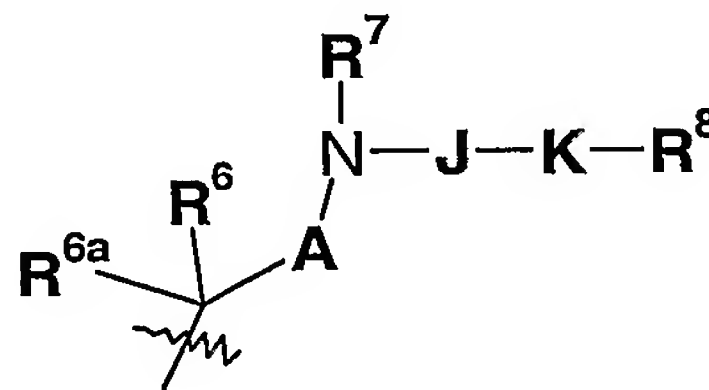
Formula (IIa)



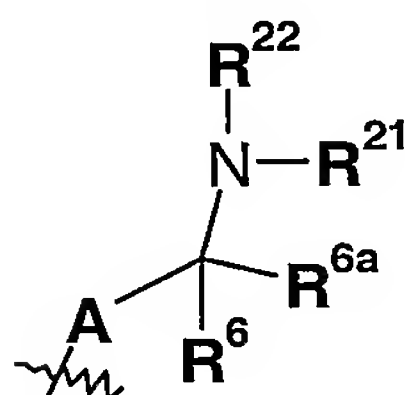
Formula (IIb)



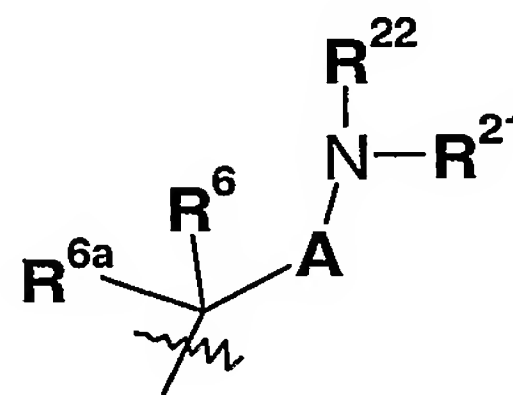
Formula (IIc)



Formula (IId)

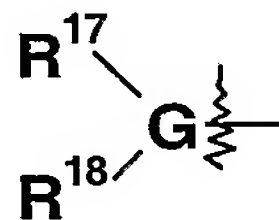


Formula (IIe)



Formula (IIIf)

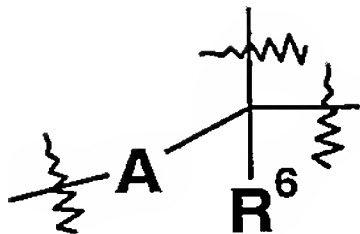
R^5 is a group of Formula (III):

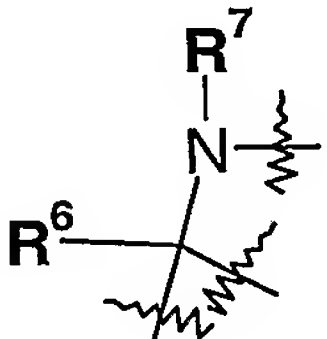


Formula (III)

15 R^6 and R^{6a} are independently selected from hydrogen, optionally substituted C_{1-6} alkyl, optionally-substituted aryl or optionally substituted aryl C_{1-6} alkyl, or R^6 and R^{6a} taken together and the carbon atom to which they are attached form a carbocyclic ring of 3-7 atoms, or R^6 and R^{6a} taken together and the carbon atom to which they are attached form a carbonyl group;

- 10 -

or when **A** is not a direct bond the group  forms a carbocyclic ring of 3-7 carbon atoms or a heterocyclic ring containing one or more heteroatoms;

or the group  forms a heterocyclic ring containing 3-7 carbon atoms and one or more heteroatoms;

- 5 **R**⁷ is selected from: hydrogen, optionally-substituted C₁₋₆alkyl, optionally-substituted arylC₁₋₆alkyl, optionally-substituted aryl, optionally substituted heterocyclyl, optionally substituted heterocyclylC₁₋₆alkyl, **R**⁹OC₁₋₆alkyl-, **R**⁹**R**¹⁰NC₁₋₆alkyl-, **R**⁹**R**¹⁰NC(O)C₁₋₆alkyl, -C(NR⁹R¹⁰)=NH;
- or when **R**³ is a group of Formula (IIc) or (IId) **R**⁷ is of the formula -**J-K-R**⁸;
- 10 **R**⁸ is selected from:
- (i) hydrogen, C₁₋₆alkyl, C₂₋₆alkenyl, C₂₋₆alkynyl, haloC₁₋₆alkyl, C₁₋₄alkoxyC₁₋₄alkyl, hydroxy, hydroxyC₁₋₆alkyl, cyano, N-C₁₋₄alkylamino, N,N-di-C₁₋₄alkylamino, C₁₋₆alkyl-S(O_n)-, -O-**R**^b, -NR^b**R**^c, -C(O)-**R**^b, -C(O)O-**R**^b, -CONR^b**R**^c or NH-C(O)-**R**^b,
 - 15 where **R**^b and **R**^c are independently selected from hydrogen and C₁₋₄alkyl optionally substituted with hydroxy, amino, N-C₁₋₄alkylamino, N,N-di-C₁₋₄alkylamino, HO-C₂₋₄alkyl-NH- or HO-C₂₋₄alkyl-N(C₁₋₄alkyl)-;
 - (ii) nitro when **B** is a group of Formula (IV) and **X** is CH and **p** is 0;
 - (iii) C₃₋₇cycloalkyl, aryl or arylC₁₋₆alkyl each of which is optionally substituted by **R**¹², **R**¹³ and **R**¹⁴;
 - 20 (iv) -(**Q**)-aryl, -(**Q**)-heterocyclyl, -aryl-(**Q**)-aryl, each of which is optionally substituted by **R**¹², **R**¹³ and **R**¹⁴ wherein -(**Q**)- is selected from **E**, **F** or a direct bond;
 - (v) heterocyclyl or heterocyclylC₁₋₆alkyl each of which is optionally substituted by **R**¹², **R**¹³ and **R**¹⁴;
 - 25 (vi) a group selected from **R**¹², **R**¹³ and **R**¹⁴;
- R**⁹ and **R**¹⁰ are independently selected from: hydrogen, hydroxy, optionally substituted C₁₋₆alkyl, optionally substituted aryl, optionally substituted arylC₁₋₆alkyl, an optionally

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substituted carbocyclic ring of 3-7 atoms, optionally substituted heterocyclyl, optionally substituted heterocyclylC₁₋₆alkyl or **R**⁹ and **R**¹⁰ taken together can form an optionally substituted ring of 3-9 atoms or **R**⁹ and **R**¹⁰ taken together with the carbon atom to which they are attached form a carbonyl group;

- 5 **R**¹¹ is selected from: hydrogen, optionally substituted C₁₋₆alkyl, or N(**R**⁹**R**¹⁰);
R¹² is selected from: hydrogen, hydroxy, **R**¹⁷**R**¹⁸N-, optionally substituted C₁₋₆alkyl-SO₂N(**R**⁹)-, optionally substituted aryl-SO₂N(**R**⁹)-, C₁₋₃perfluoroalkyl-SO₂N(**R**⁹)-; optionally substituted C₁₋₆alkyl-N(**R**⁹)SO₂-, optionally substituted aryl-N(**R**⁹)SO₂-, C₁₋₃perfluoroalkyl-N(**R**⁹)SO₂- optionally substituted C₁₋₆alkanoyl-N(**R**⁹)SO₂-, optionally substituted aryl-C(O)N(**R**⁹)SO₂-, optionally substituted C₁₋₆alkyl-S(O_n) -, optionally substituted aryl-S(O_n) -, C₁₋₃perfluoroalkyl-, C₁₋₃perfluoroalkoxy, optionally substituted C₁₋₆alkoxy, carboxy, halo, nitro or cyano;
10 **R**¹³ and **R**¹⁴ are independently selected from: hydrogen, optionally substituted C₁₋₆alkyl, optionally substituted C₂₋₆alkenyl, cyano, nitro, C₁₋₃perfluoroalkyl-, C₁₋₃perfluoroalkoxy, optionally substituted aryl, optionally substituted arylC₁₋₆alkyl, **R**⁹O(CH₂)_s-, **R**⁹(O)O(CH₂)_s-, **R**⁹OC(O)(CH₂)_s-, **R**¹⁶S(O_n)(CH₂)_s-, **R**⁹**R**¹⁰NC(O)(CH₂)_s- or halo;
15 **R**¹⁵ is selected from: hydrogen, optionally substituted C₁₋₆alkyl, **R**¹⁹OC(O)-, **R**⁹**R**¹⁰NC(O)-, **R**⁹C(O)-, **R**⁹S(O_n)-;
20 **R**¹⁶ is selected from: hydrogen, C₁₋₆alkyl, C₁₋₃perfluoroalkyl or optionally-substituted aryl;
R¹⁷ is independently selected from: hydrogen, hydroxy, cyano or optionally substituted C₁₋₆alkyl;
R¹⁸ is a group of formula **R**^{18a}-C(**R**⁹**R**¹⁰)₀₋₁- wherein **R**^{18a} is selected from: **R**¹⁹OC(O)-, **R**⁹**R**¹⁰NC(O)-, **R**⁹**R**¹⁰N-, **R**⁹C(O)-, **R**⁹C(O)N(**R**¹⁰)-, **R**⁹**R**¹⁰NC(O)-, **R**⁹**R**¹⁰NC(O)N(**R**¹⁰)-, **R**⁹SO₂N(**R**¹⁰)-, **R**⁹**R**¹⁰NSO₂N(**R**¹⁰)-, **R**⁹C(O)O-, **R**⁹OC(O)-, **R**⁹**R**¹⁰NC(O)O-, **R**⁹O-, **R**⁹S(O_n)-, **R**⁹**R**¹⁰NS(O_n) -, optionally substituted C₁₋₆alkyl, optionally substituted heterocyclyl;
25 or **R**¹⁷ and **R**¹⁸ when taken together form an optionally substituted carbocyclic ring of 3-7 atoms or optionally substituted heterocyclyl;
30 **R**¹⁹ is selected from: hydrogen, optionally substituted C₁₋₆alkyl, optionally substituted aryl, optionally substituted arylC₁₋₆alkyl, optionally substituted C₃₋₇cycloalkyl, optionally substituted heterocyclyl or optionally substituted heterocyclylC₁₋₆alkyl;
R²⁰ is selected from **R**¹² or **R**¹³;

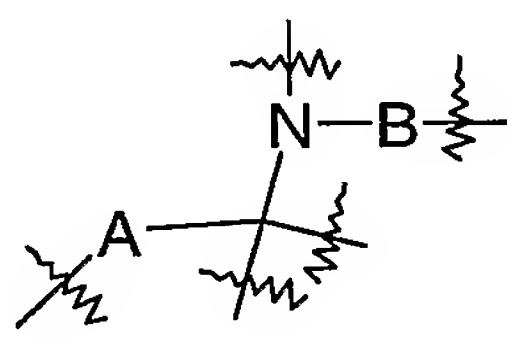
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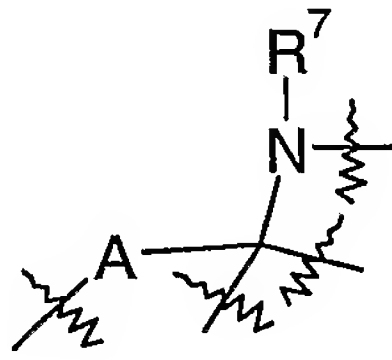
- R^{21} and R^{22} are independently selected from hydrogen, optionally substituted C_{1-6} alkyl, optionally substituted C_{3-7} cycloalkyl, optionally substituted heterocyclyl, optionally substituted heterocyclyl C_{1-6} alkyl, optionally substituted C_{3-6} alkenyl, optionally substituted C_{3-6} alkynyl, $-(C_{1-5}alkyl)_{aa}-S(O_n)-(C_{1-5}alkyl)_{bb}-$; $R^9R^{10}NC_{2-6}alkyl$, $R^9OC_{2-6}alkyl$ or $R^9R^{10}NC(O)C_{2-6}alkyl$, with the proviso that R^9 and R^{10} independently or taken together are not optionally substituted aryl or optionally substituted aryl C_{1-6} alkyl; or

R^{21} and R^{22} taken together form an optionally substituted non-aromatic heterocyclic ring;

A is selected from:

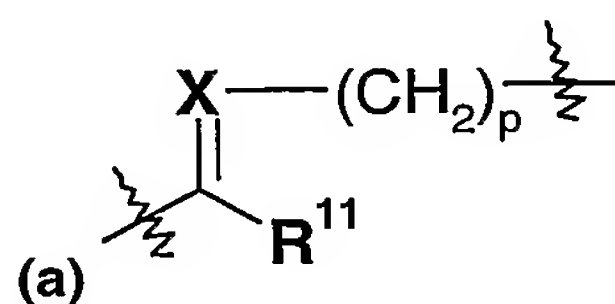
- 10 (i) a direct bond;
- (ii) optionally-substituted C_{1-5} alkylene wherein the optional substituents are independently selected from: optionally-substituted C_{1-6} alkyl, optionally-substituted aryl, optionally substituted aryl C_{1-6} alkyl or substituted aryl C_{1-6} alkyl;
- 15 (iii) a carbocyclic ring of 3-7 atoms;
- (iv) a carbonyl group;

or when R^3 is a group of Formula (IIa) or (IIb), the group  forms a heterocyclic ring containing 3-7 carbon atoms and one or more heteroatoms;

or when R^3 is a group of Formula (IIa), (IIb), (IIc) or (IId), the group  forms a heterocyclic ring containing 3-7 carbon atoms and one or more heteroatoms;

B is selected from:

- (i) a direct bond;
- (ii) a group of Formula (IV)



Formula (IV)

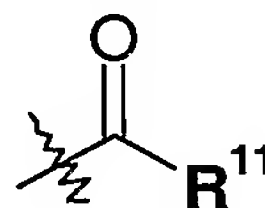
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wherein:

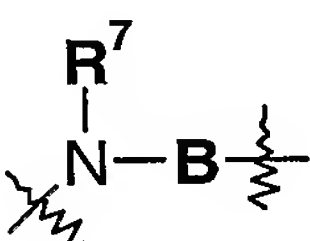
X is selected from N or CH,

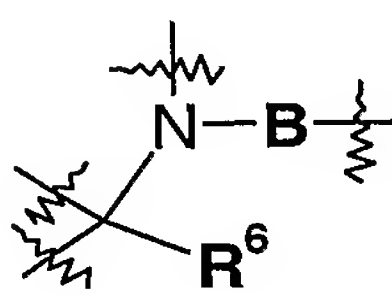
wherein at position (a) Formula (IV) is attached to the nitrogen atom and the (CH₂)_p group is attached to **R**⁸; and

- 5 (iii) a group independently selected from: optionally substituted C₁₋₆alkylene, optionally substituted C₃₋₇cycloalkyl, optionally substituted C₃₋₆alkenylene, optionally substituted C₃₋₆alkynyl, C₁₋₆alkoxy, (C₁₋₅alkyl)_{aa}-S(O_n)-(C₁₋₅alkyl)_{bb}-, (C₁₋₅alkyl)_{aa}-O-(C₁₋₅alkyl)_{bb}- or (C₁₋₅alkyl)_{aa}-N(**R**¹⁵)-(C₁₋₅alkyl)_{bb}, wherein **R**¹⁵ and the (C₁₋₅alkyl)_{aa} or (C₁₋₅alkyl)_{bb} chain can be joined to form a ring;
- 10 or the group -**B-R**⁸ represents a group of Formula (V)



Formula (V);

or the group  together forms a heterocyclic ring containing 5-7 carbons atoms;

15 or the group  forms a heterocyclic ring containing 3-7 carbon atoms and one or more heteroatoms;

E is -O-, -S(O_n), -C(O)-, -NR¹⁵- or -C(**R**⁹**R**¹⁰)_q;

F is -**E**(CH₂)_r-;

G is selected from: hydrogen, halo, N, O, S(O_n), C(O), C(**R**⁹**R**¹⁰)_t, optionally substituted C₂₋₆alkenylene, optionally substituted C₂₋₆alkynylene or a direct bond to **R**¹⁸,

J is a group of the formula: -(CH₂)_s-**L**-(CH₂)_s- wherein when s is greater than 0, the alkylene group is optionally substituted

K is selected from: a direct bond, -O-(CH₂)_s-, -C(O)-(CH₂)_s-, -S(O_n)-(CH₂)_s-, -N(**R**¹⁸)-(CH₂)_s-, -OC(O)-(CH₂)_s-, -C(O)O-(CH₂)_s-, -OS(O_n)-(CH₂)_s-, or

25 -S(O_n)-O-(CH₂)_s-;

L is selected from optionally substituted aryl or optionally substituted heterocyclyl;

M is -(CH₂)₀₋₂-O-;

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n is an integer between 0 and 2;

p is an integer between 0 and 4;

q is an integer between 0 and 4;

r is an integer between 0 and 4;

5 **s** is an integer between 0 and 4; and

t is an integer between 0 and 4;

with the proviso that

(i) when **G** is hydrogen or halo, then **R**¹⁷ and **R**¹⁸ are both absent;

10 (ii) when **G** is O, S(O_n), C(O) or C(**R**¹¹**R**¹²)_t then **G** is substituted by a single group independently selected from the definition of **R**¹⁷ or **R**¹⁸ and when **G** is a direct bond to **R**¹⁸ then **G** is substituted by a single group selected from **R**¹⁸; and

or a salt, solvate or pro-drug thereof.

According to a further feature of the first aspect of the invention there is provided a pharmaceutical formulation comprising a compound of Formula (I) or Formula (Ia), or salt,
15 pro-drug or solvate thereof, and a pharmaceutically acceptable diluent or carrier.

According to a further feature of the first aspect of the invention there is provided the following uses of a compound of Formula (I) or Formula (Ia), or salt, pro-drug or solvate thereof:

- 20 (a) the use in the manufacture of a medicament for antagonising gonadotropin releasing hormone activity;
- (b) the use in the manufacture of a medicament for administration to a patient, for reducing the secretion of luteinizing hormone by the pituitary gland of the patient; and
- (c) the use in the manufacture of a medicament for administration to a patient, for therapeutically treating and/or preventing a sex hormone related condition in the patient,
25 preferably a sex hormone related condition selected from prostate cancer and pre-menopausal breast cancer.

According to a further aspect of the invention there is provided a method of antagonising gonadotropin releasing hormone activity in a patient, comprising administering a compound of Formula (I) or Formula (Ia), or salt, pro-drug or solvate thereof, to a patient.

30 Whilst pharmaceutically-acceptable salts of compounds of the invention are preferred, other non-pharmaceutically-acceptable salts of compounds of the invention may also be useful, for example in the preparation of pharmaceutically-acceptable salts of compounds of the invention.

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Whilst the invention comprises compounds of the invention, and salts, pro-drugs or solvates thereof, in a further embodiment of the invention, the invention comprises compounds of the invention and salts thereof.

In the present specification, unless otherwise indicated, an **alkyl**, **alkylene**, **alkenyl** or
5 **alkynyl** moiety may be linear or branched. The term "**alkylene**" refers to the group $-\text{CH}_2-$. Thus, C_8 alkylene for example is $-(\text{CH}_2)_8-$. For avoidance of doubt the term C_0 alkyl within the group $\text{C}_{0.5}$ alkyl is a direct bond.

The term '**propylene**' refers to trimethylene and the branched alkyl chains $-\text{CH}(\text{CH}_3)\text{CH}_2-$ and $-\text{CH}_2-\text{CH}(\text{CH}_3)-$. The straight chain propylene di-radical is preferred, i.e.
10 $-\text{CH}_2\text{CH}_2\text{CH}_2-$. Specific propylene radicals refer to the particular structure, thus the term, propyl-2-ene refers to the group $-\text{CH}_2-\text{CH}(\text{CH}_3)-$. Similar notation is used for other divalent alkyl chains such as butylene.

The term '**2-propenyl**' refers to the group $-\text{CH}_2-\text{CH}=\text{CH}-$.

The term "**aryl**" refers to phenyl or naphthyl.

15 The term "**carbamoyl**" refers to the group $-\text{C}(\text{O})\text{NH}_2$.

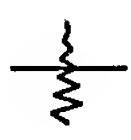
The term "**halo**" refers to fluoro, chloro, bromo or iodo.

The term "**heterocyclyl**" or "**heterocyclic ring**" refers to a 4-12 membered, preferably 5-10 membered aromatic mono or bicyclic ring or a 4-12 membered, preferably 5-10 membered saturated or partially saturated mono or bicyclic ring, said aromatic, saturated or
20 partially unsaturated rings containing up to 5 heteroatoms independently selected from nitrogen, oxygen or sulphur, linked via ring carbon atoms or ring nitrogen atoms where a bond from a nitrogen is allowed, for example no bond is possible to the nitrogen of a pyridine ring, but a bond is possible through the 1-nitrogen of a pyrazole ring. Examples of 5- or 6-membered aromatic heterocyclic rings include pyrrolyl, furanyl, imidazolyl, triazolyl,
25 pyrazinyl, pyrimidinyl, pyridazinyl, pyridinyl, isoxazolyl, oxazolyl, 1,2,4 oxadiazolyl, isothiazolyl, thiazolyl and thienyl. A 9 or 10 membered bicyclic aromatic heterocyclic ring is an aromatic bicyclic ring system comprising a 6-membered ring fused to either a 5 membered ring or another 6 membered ring. Examples of 5/6 and 6/6 bicyclic ring systems include benzofuranyl, benzimidazolyl, benzthiophenyl, benzthiazolyl, benzisothiazolyl, benzoxazolyl,
30 benzisoxazolyl, indolyl, pyridoimidazolyl, pyrimidoimidazolyl, quinoliny, isoquinoliny, quinoxaliny, quinazoliny, phthalaziny, cinnoliny and naphthyridiny. Examples of saturated or partially saturated heterocyclic rings include pyrroliny, pyrrolidinyl, morpholiny, piperidinyl, piperazinyl, dihydropyridiny, benzodioxyl and dihydropyrimidinyl.

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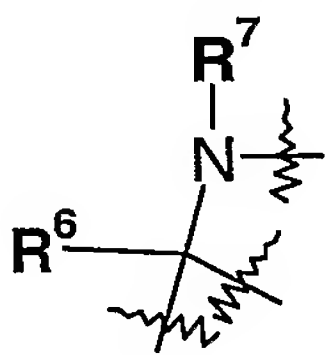
This definition further comprises sulphur-containing rings wherein the sulphur atom has been oxidised to an S(O) or S(O₂) group.

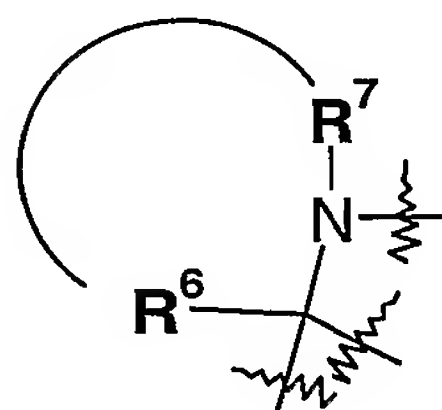
The term "**aromatic ring**" refers to a 5-10 membered aromatic mono or bicyclic ring optionally containing up to 5 heteroatoms independently selected from nitrogen, oxygen or sulphur. Examples of such "aromatic rings" include: phenyl, pyrrolyl, pyrazolyl, furanyl, imidazolyl, triazolyl, pyrazinyl, pyrimidinyl, pyridazinyl, pyridinyl, isoxazolyl, oxazolyl, 1,2,4 oxadiazolyl, isothiazolyl, thiazolyl and thienyl. Preferred aromatic rings include phenyl, thienyl and pyridyl.

The symbol  denotes where the respective group is linked to the remainder of the molecule.

For the avoidance of doubt where two groups or integers appear within the same definition, for example, $-(CH_2)_s-L-(CH_2)_s-$ or $R^9R^{10}NSO_2N(R^{10})-$, then these can be the same or different.

For the avoidance of doubt, where several groups together form a ring, for example:

15 'the group  forms a heterocyclic ring containing 3-7 carbon atoms and one or more heteroatoms', then the groups shown cyclises to form a ring, i.e



the component of which are defined by the definitions of the groups which form the ring, thus in the above example the ring would include a nitrogen atom. For example in Example 5 this group forms a piperazine ring.

20 The term **C₁₋₃perfluoroalkyl** refers to a C₁₋₃alkyl chain in which all hydrogens have been replaced with a fluorine atom. Examples of **C₁₋₃perfluoroalkyl** include trifluoromethyl, pentafluoroethyl and 1-trifluoromethyl-1,2,2,2-tetrafluoroethyl-. Preferably **C₁₋₃perfluoroalkyl** is trifluoromethyl.

Examples of **C₁₋₈alkyl** include: methyl, ethyl, propyl, isopropyl, butyl, *iso*-butyl, *tert*-butyl and 2-methyl-pentyl; example of **C₁₋₈alkylene** include: methylene, ethylene and 2-methyl-propylene; examples of **C₁₋₆alkenyl** include allyl (2-propenyl) and 2-butenyl,

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examples of **C₁₋₆alkynyl** 2-propynyl and 3-butynyl, examples of **haloC₁₋₆alkyl** include fluoroethyl, chloropropyl and bromobutyl, examples of **hydroxyC₁₋₆alkyl** include hydroxymethyl, hydroxyethyl and hydroxybutyl, examples of **C₁₋₈alkoxy** include methoxy, ethoxy and butyloxy; examples of **C₁₋₄alkoxyC₁₋₄alkyl** include methoxyethyl, propoxybutyl
 5 and propoxymethyl, examples of **C₁₋₆alkanoyl** include formyl, ethanoyl, propanoyl or pentanoyl, examples of **N-C₁₋₄alkylamino** include N-methylamino and N-ethylamino; examples of **N,N-di-C₁₋₄alkylamino** include N,N-dimethylaminoethyl, N,N-di-methylaminopropyl and N,N-dipropylaminoethyl, examples of **HO-C₂₋₄alkyl-NH** include hydroxymethylamino hydroxyethylamino and hydroxypropylamino, examples of
 10 **HO-C₂₋₄alkyl-N(C₁₋₄alkyl)** include N-methyl-hydroxymethylamino, N-ethyl-hydroxyethylamino, and N-propyl-hydroxypropylamino, examples of **C₁₋₆alkyl-S(O_n)-methylthio**, methylsulphinyl, ethylsulphinyl, ethylsulphonyl and propylsulphonyl, include examples of **arylC₁₋₆alkyl** include benzyl, phenethyl and phenylbutyl, examples of **heterocyclylC₁₋₆alkyl** include pyrrolidin-1-yl ethyl, imidazolylethyl, pyridylmethyl and
 15 pyrimidinylethyl.

It is to be understood that, insofar as certain of the compounds of the invention may exist in optically active or racemic forms by virtue of one or more asymmetric carbon atoms, the invention includes in its definition any such optically active or racemic form which possesses the property of antagonizing gonadotropin releasing hormone (GnRH) activity. The
 20 synthesis of optically active forms may be carried out by standard techniques of organic chemistry well known in the art, for example by synthesis from optically active starting materials or by resolution of a racemic form. Similarly, activity of these compounds may be evaluated using the standard laboratory techniques referred to hereinafter.

The invention also relates to any and all tautomeric forms of the compounds of the
 25 different features of the invention that possess the property of antagonizing gonadotropin releasing hormone (GnRH) activity.

It will also be understood that certain compounds of the present invention may exist in solvated, for example hydrated, as well as unsolvated forms. It is to be understood that the present invention encompasses all such solvated forms which possess the property of
 30 antagonizing gonadotropin releasing hormone (GnRH) activity.

Preferred compounds of Formula (I), Formula (Ia) and Formula (Ib) are those wherein any one of the following apply.

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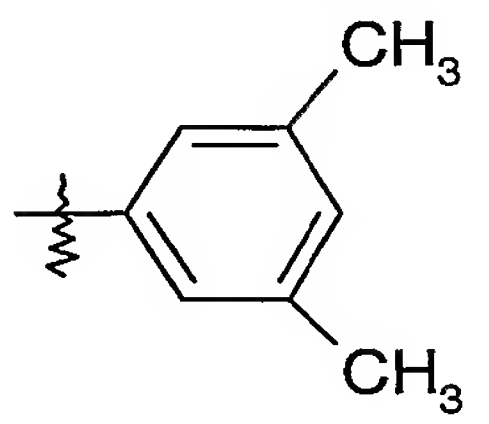
Preferably R^1 is selected from hydrogen or optionally substituted C_{1-6} alkyl. More preferably R^1 represents hydrogen or unsubstituted C_{1-6} alkyl. Yet more preferably R^1 represents hydrogen, methyl, ethyl or *tert*-butyl. Most preferably R^1 represents hydrogen.

Preferably optional substituents on R^1 are independently selected from: optionally substituted C_{1-6} alkyl, optionally substituted C_{2-6} alkenyl, cyano, nitro, C_{1-3} perfluoroalkyl, C_{1-3} perfluoroalkoxy, optionally substituted aryl, optionally substituted aryl C_{1-6} alkyl, $R^9O(CH_2)_v$ -, $R^9C(O)O(CH_2)_v$ -, $R^9OC(O)(CH_2)_v$ -, $R^{16}S(O_n)(CH_2)_v$ -, $R^9R^{10}NC(O)(CH_2)_v$ -, or halo wherein v is an integer between 0 and 4, and where 2 optional substituents are present together they can optionally form a C_{3-7} carbocyclic ring or a heterocyclic ring.

10 Preferably R^2 is an optionally substituted monocyclic aromatic ring structure. Most preferably R^2 represents optionally substituted phenyl.

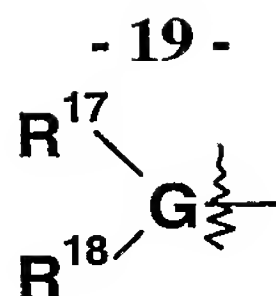
Preferably optional substituents on R^2 are independently selected from: optionally substituted C_{1-6} alkyl, optionally substituted C_{2-6} alkenyl, cyano, nitro, C_{1-3} perfluoroalkyl, C_{1-3} perfluoroalkoxy, optionally substituted aryl, optionally substituted aryl C_{1-6} alkyl, $R^9O(CH_2)_p$ -, $R^9C(O)O(CH_2)_w$ -, $R^9OC(O)(CH_2)_w$ -, $R^{16}S(O_n)(CH_2)_w$ -, $R^9R^{10}NC(O)(CH_2)_w$ -, $R^9R^{10}N$ - or halo; wherein w is an integer between 0 and 4 and R^9 and R^{10} are as defined above. Further preferably the optional substituents on R^2 are independently selected from cyano, R^eR^fN -, optionally substituted C_{1-6} alkyl (preferably, C_{1-4} alkyl, eg, methyl or ethyl), optionally substituted C_{1-6} alkoxy (preferably, C_{1-4} alkoxy, eg, methoxy, ethoxy or *tert*-butoxy) or halo (eg, F, Br or Cl) wherein R^e and R^f are independently selected from hydrogen, C_{1-6} alkyl or aryl. Yet further preferably optional substituents on R^2 are independently selected from methyl, ethyl, methoxy, ethoxy, *tert*-butoxy, F or Cl. Most preferably optional substituents on R^2 are independently selected from methyl, F or Cl. Preferably R^2 bears 1, 2 or 3 substituents.

25 Most preferably R^2 represents



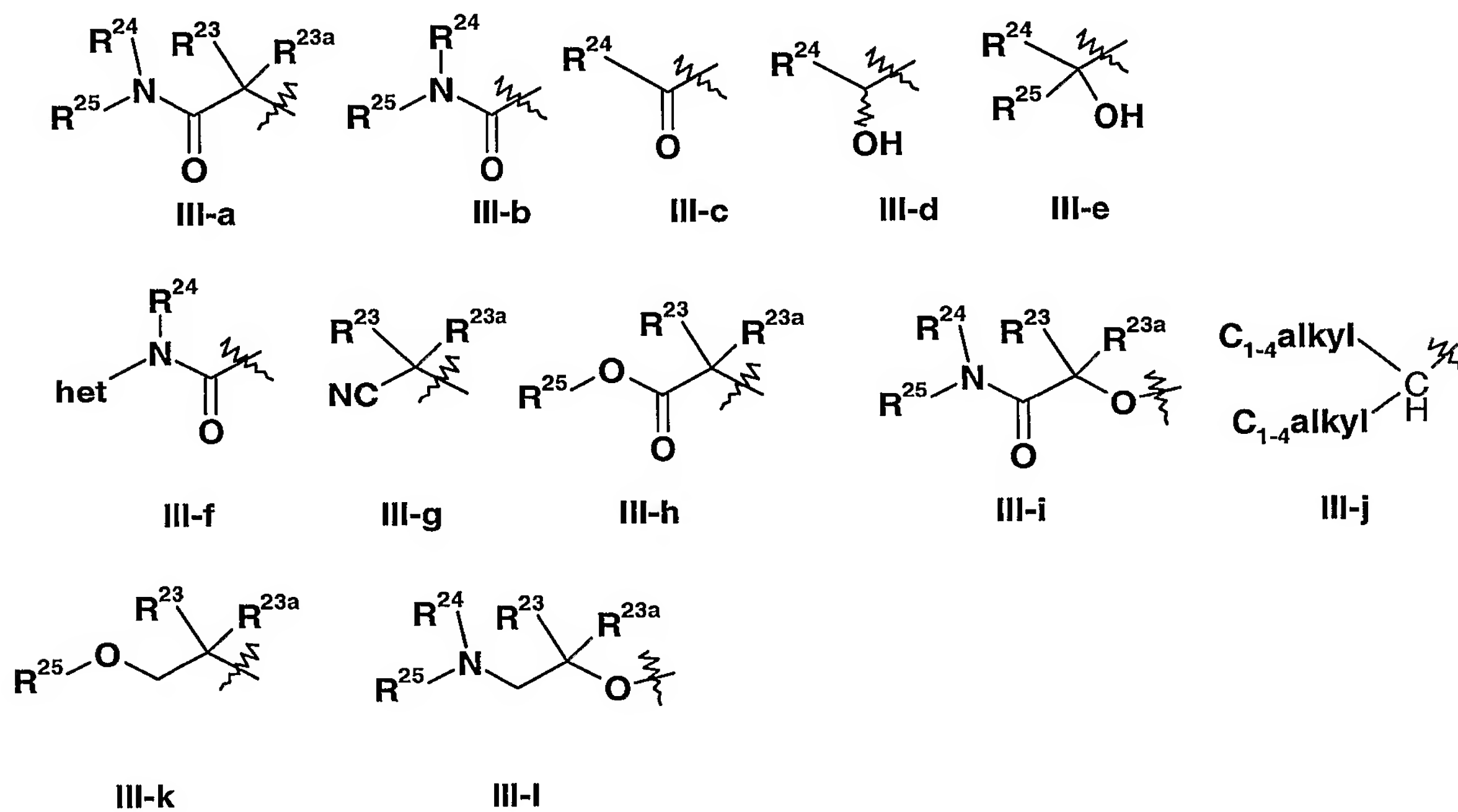
Preferably R^3 is selected from a group of Formula (IIa) Formula (IIb), Formula (IIc) or Formula (IId). Further preferably R^3 is selected from Formula (IIa) or Formula (IIb). Most preferably R^3 is a group of Formula (IIb).

30 Preferably the group of Formula (III):



Formula (III)

is selected from a group of Formula **III-a**; **III-b**; **III-c**; **III-d**; **III-e**; **III-f**, **III-g**, **III-h**, **III-i**, or **III-j**, **III-k** or **III-l**;



wherein:

het represents an optionally substituted 3- to 8- membered heterocyclic ring containing from 1 to 4 heteroatoms independently selected from O, N and S;

R²³ and **R^{23a}** are independently selected from:

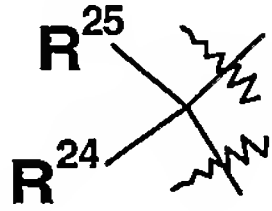
- (i) hydrogen or optionally substituted C₁₋₈alkyl; or
- (ii) **R²³** and **R^{23a}** together with the carbon to which they are attached form an optionally substituted 3 to 7-membered cycloalkyl ring;

R²⁴ and **R²⁵** are selected from:

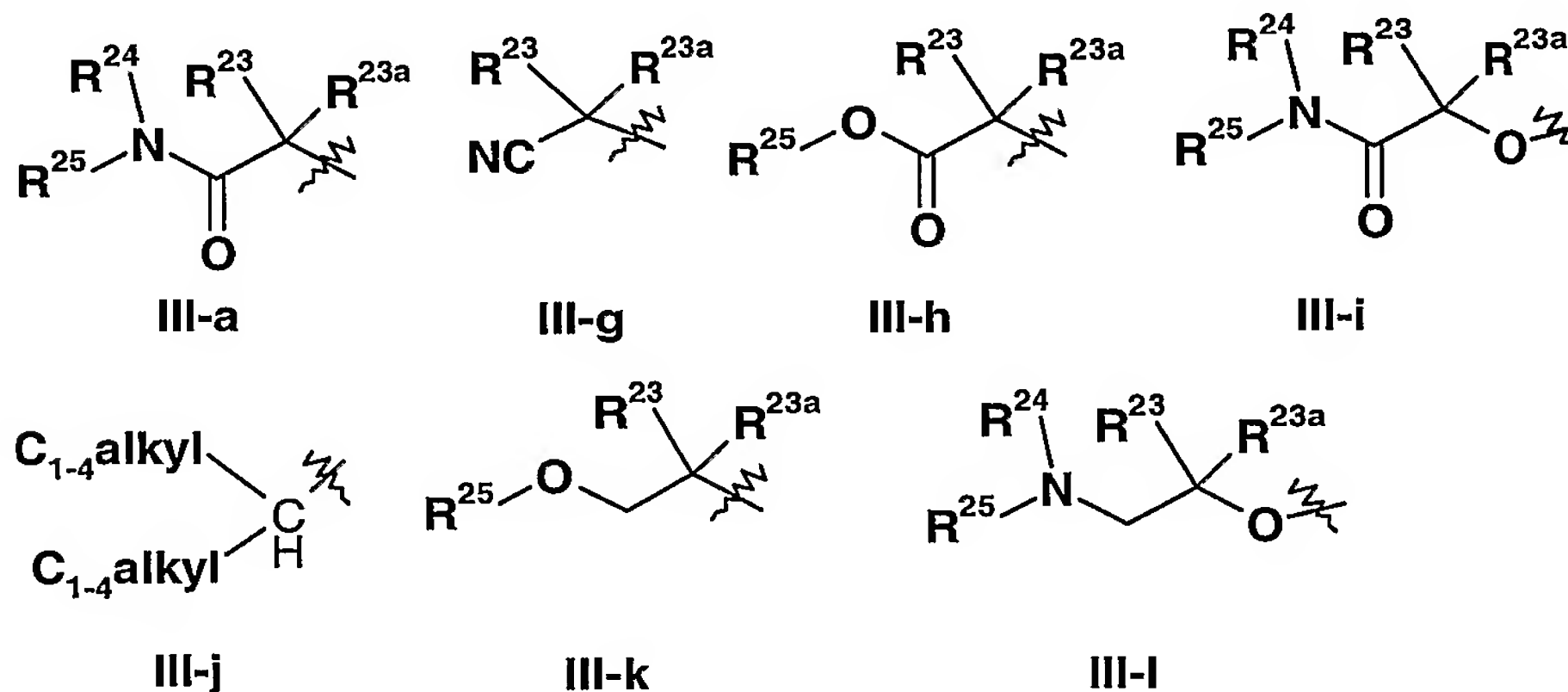
- (i) **R²⁴** selected from hydrogen; optionally substituted C₁₋₈alkyl; optionally substituted aryl; -**R^d**-Ar, where **R^d** represents C₁₋₈alkylene and Ar represents optionally substituted aryl; and optionally substituted 3- to 8- membered heterocyclic ring optionally containing from 1 to 3 further heteroatoms independently selected from O, N and S; and **R²⁵** is selected from hydrogen; optionally substituted C₁₋₈alkyl and optionally substituted aryl;

- 20 -

- (ii) wherein the group of Formula (III) represents a group of Formula **III-a**, **III-b** or **III-i**, then the group $\text{NR}^{24}(-\text{R}^{25})$ represents an optionally substituted 3- to 8-membered heterocyclic ring optionally containing from 1 to 3 further heteroatoms independently selected from O, N and S; or

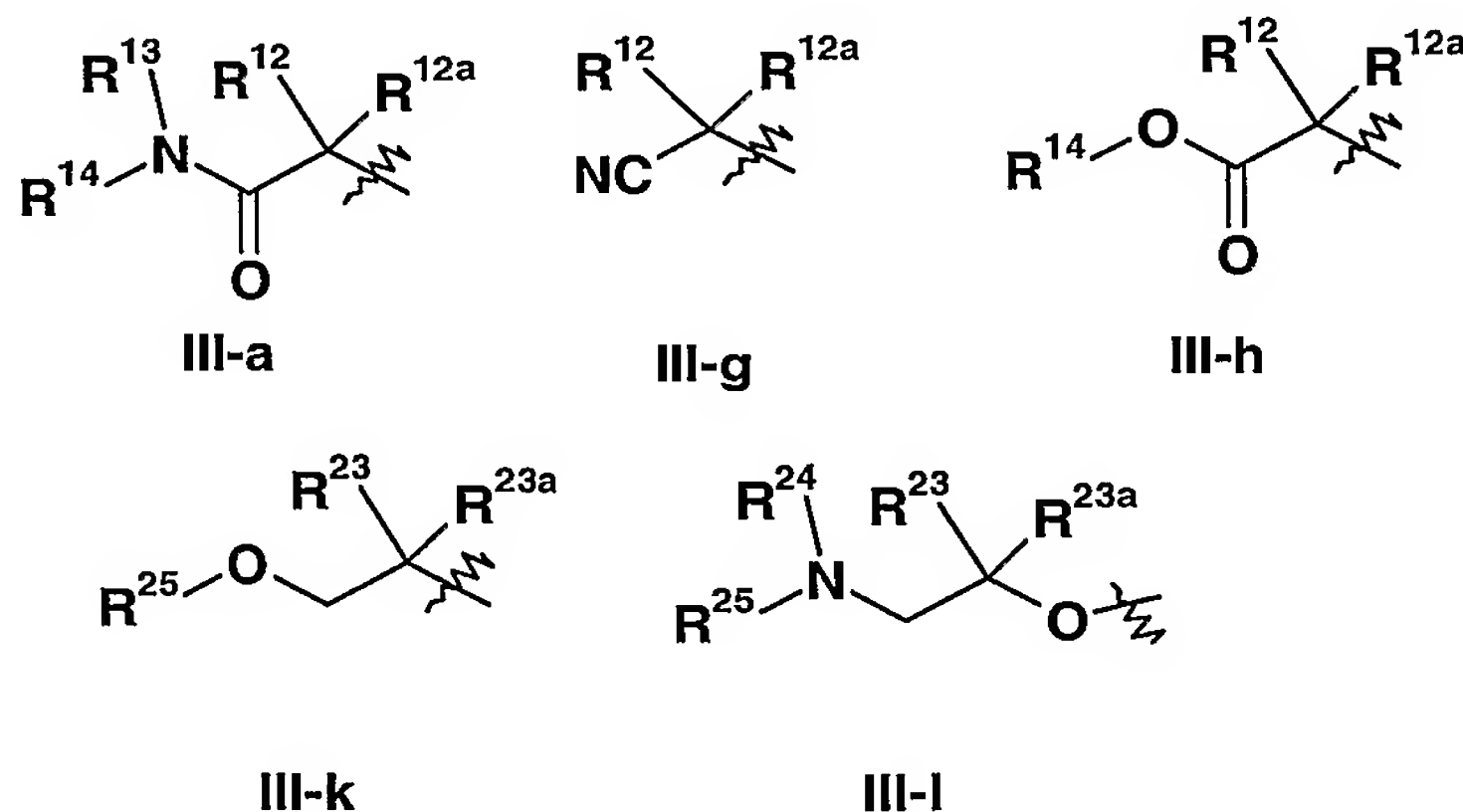
- 5 (iii) wherein the group of Formula (III) represents structure **III-e**,  represents an optionally substituted 3- to 8-membered heterocyclic ring optionally containing from 1 to 4 heteroatoms independently selected from O, N and S;

More preferably the group of Formula (III) is selected from a group of Formula **III-a**,
 10 **III-g**, **III-h**, **III-i**, **III-j**, **III-k** or **III-l**:



wherein R^{23} , R^{23a} , R^{24} and R^{25} are as defined above.

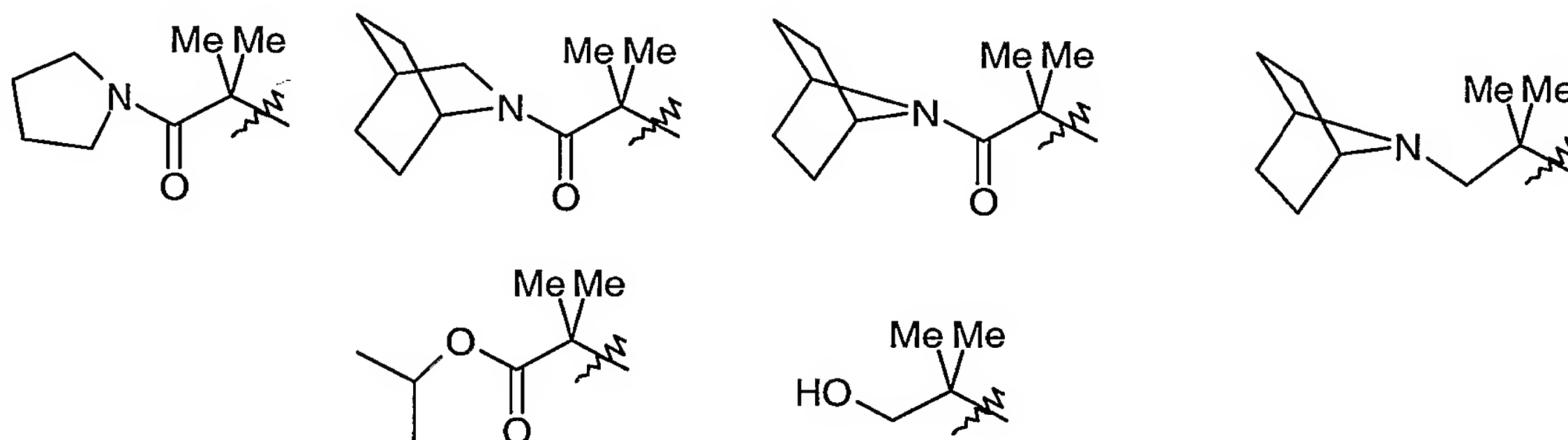
Further preferably the group of Formula (III) is selected from one of the following groups:



15 wherein R^{23} , R^{23a} , R^{24} and R^{25} are as defined above.

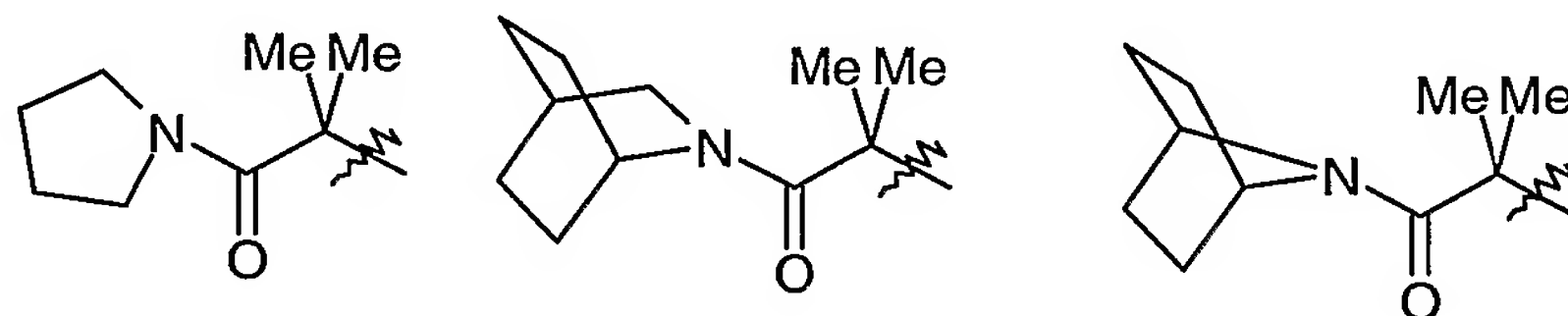
- 21 -

Yet further preferably the group of Formula (III) is selected from one of the following groups:

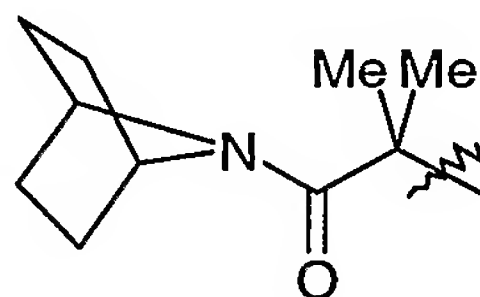


wherein Me represents methyl.

5 Yet further preferably the group of Formula (III) is selected from one of the following groups:



Most preferably the group of Formula (III) is:

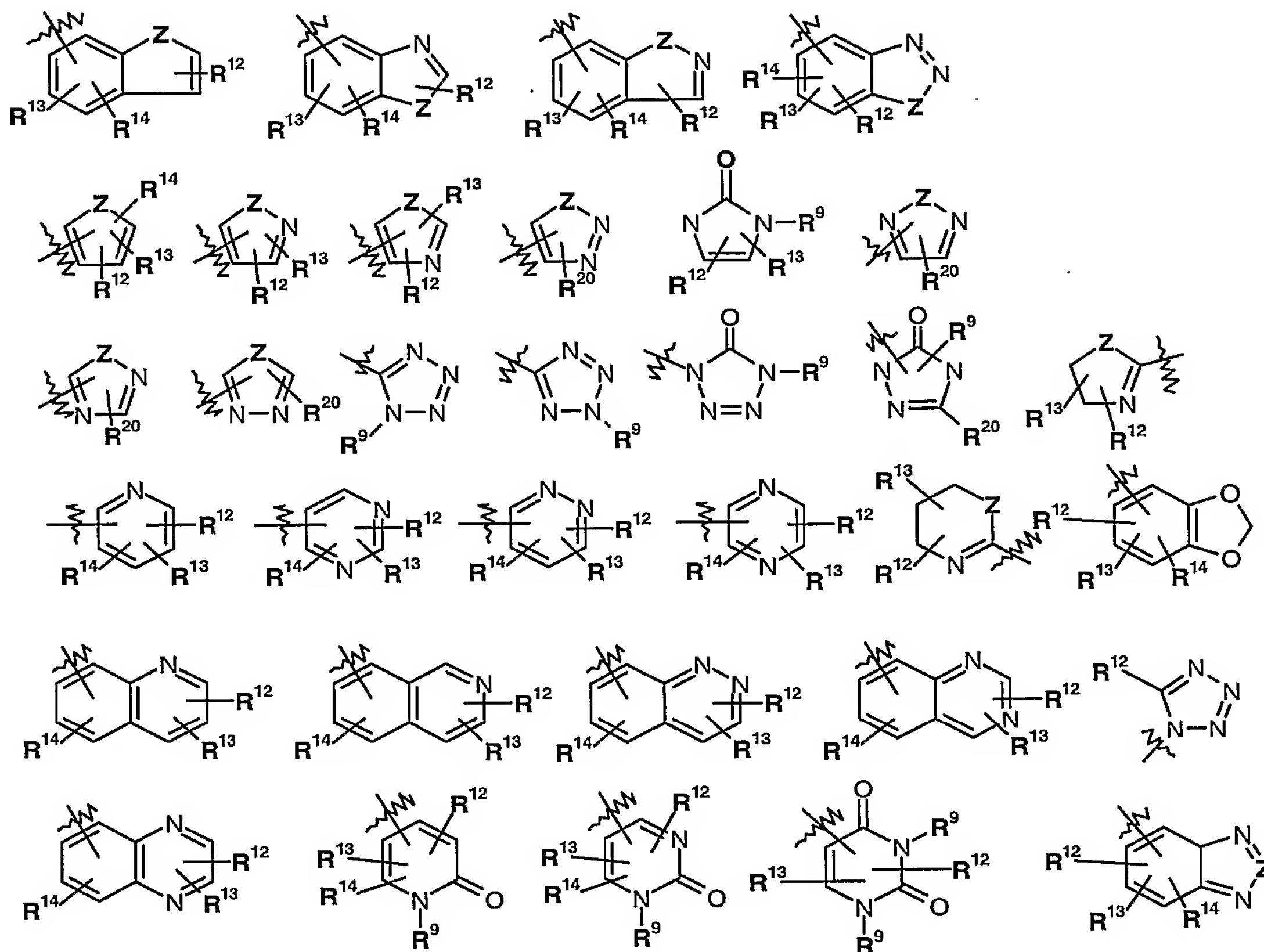


10 Preferably **R⁶** and **R^{6a}** are independently selected from hydrogen, fluoro, optionally substituted C₁₋₆alkyl or **R⁶** and **R^{6a}** taken together and the carbon atom to which they are attached form a carbocyclic ring of 3-7 atoms. More preferably **R⁶** and **R^{6a}** are independently selected from hydrogen, unsubstituted C₁₋₆alkyl or **R⁶** and **R^{6a}** taken together and the carbon atom to which they are attached form a carbocyclic ring of 3-7 atoms. Yet more preferably **R⁶** and **R^{6a}** are independently selected from hydrogen, methyl or **R⁶** and **R^{6a}** taken together and the carbon atom to which they are attached form cyclopropyl. Most preferably **R⁶** is hydrogen and **R^{6a}** is methyl.

Preferably **R⁷** is selected from: hydrogen or C₁₋₄alkyl. More preferably **R⁷** is hydrogen or methyl. Most preferably **R⁷** is hydrogen.

20 When **R⁸** is heterocyclyl then **R⁸** is preferably selected from one of the following groups:

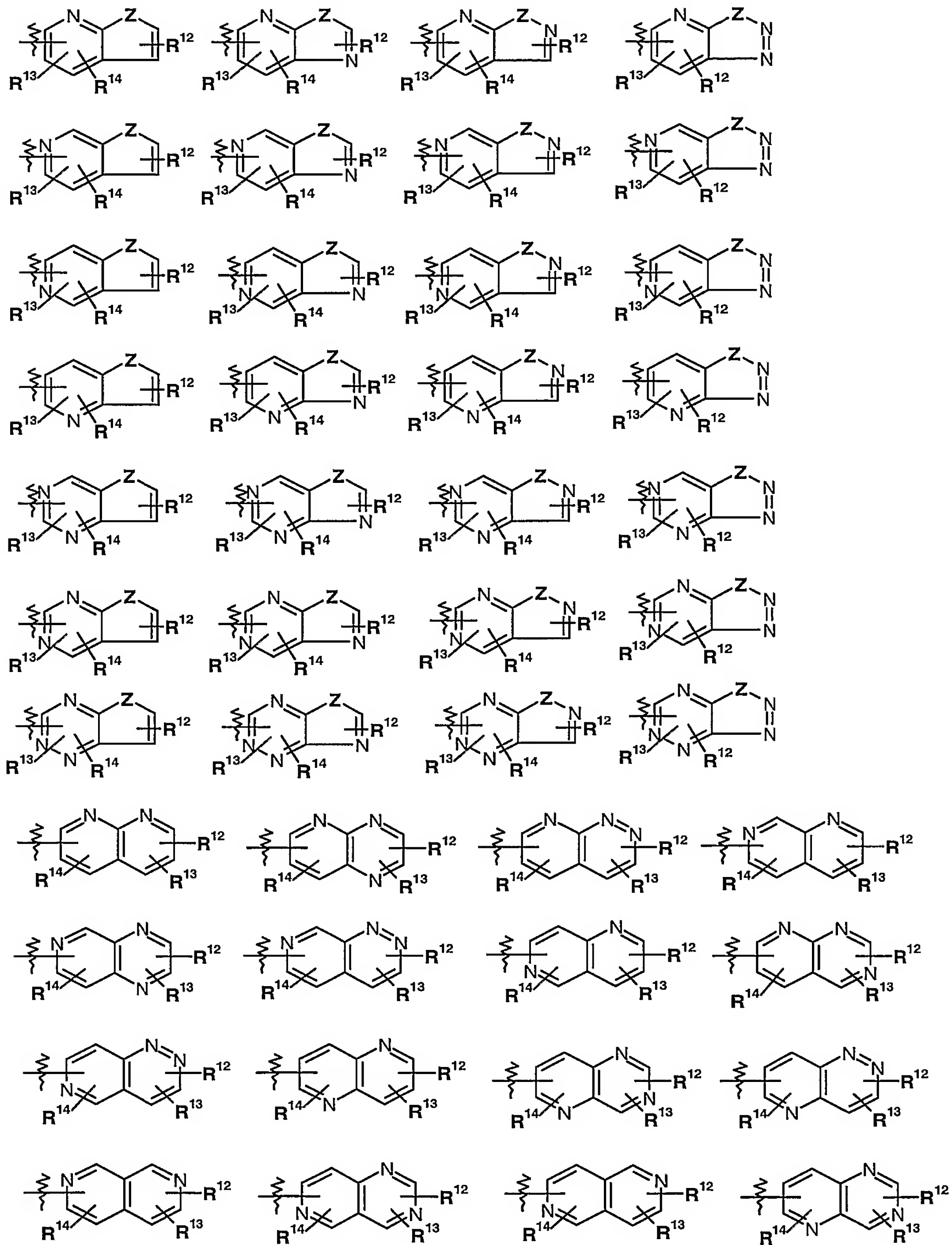
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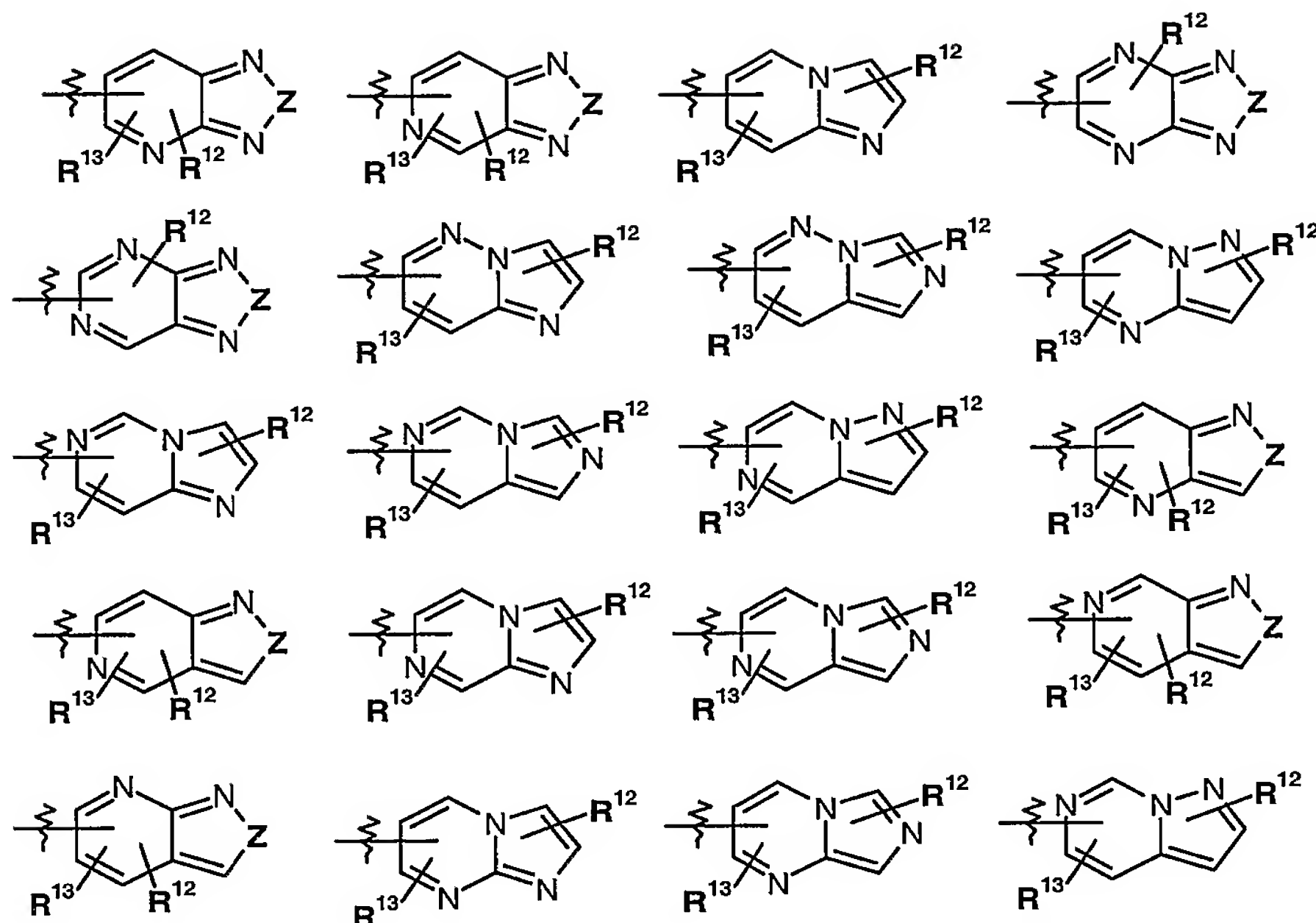
wherein Z is selected from: O, S or $N(R^9)$, R^{20} is selected from any group within the definitions of R^{12} and R^{13} , and R^9 , R^{12} , R^{13} and R^{14} are as defined above.

In a further embodiment of the invention when R^8 is heterocyclyl then R^8 is preferably
5 selected from one of the following groups:

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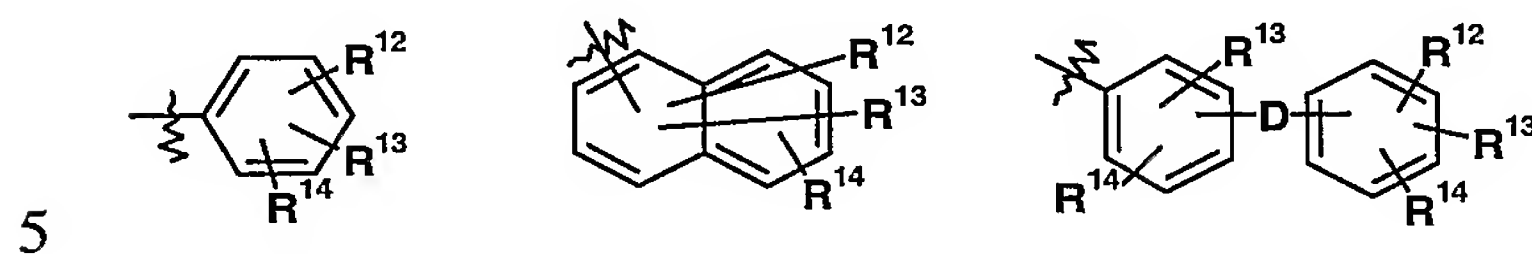


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wherein **Z** is selected from: O, S or N(**R**⁹) and **R**⁹, **R**¹² and **R**¹³ are as defined above.

When **R**⁸ is aryl or aryl-(C)-aryl optionally substituted by **R**¹², **R**¹³ and **R**¹⁴, **R**⁸ is preferably selected one of the following groups:



wherein **D** is selected from group **E**, group **F** or a direct bond;

Preferably **R**⁸ is selected from

- (i) hydrogen, C₁₋₆alkyl, C₂₋₆alkenyl, haloC₁₋₆alkyl, hydroxy, cyano, C₁₋₆alkylS(O_n)-, -O-**R**^b, C₁₋₄alkoxyC₁₋₄alkyl, -C(O)-**R**^b, C(O)O-**R**^b, -NH-C(O)-**R**^b,
 10 N,N-di-C₁₋₄alkylamino, -S(O_n)N**R**^b**R**^c
 where **R**^b and **R**^c are independently selected from hydrogen and C₁₋₆alkyl, and **n** is 0, 1 or 2;
- (ii) -(**Q**)-aryl, optionally substituted by up to 3 groups selected from **R**¹², **R**¹³ and **R**¹⁴;
- (iii) C₄₋₇heterocyclyl, optionally substituted by up to 3 groups selected from **R**¹², **R**¹³ and
 15 **R**¹⁴,
 more preferably selected from: aziriny, azetidiny, pyrrolidiny, pyrazoliny,
 pyrazolidiny, imidazoliny, imidazolidiny, piperidiny, piperaziny,
 hexahydropyrimidiny, hexahydropyridaziny, hexahydrotriaziny, tetrahydrotriaziny,
 dihydrotriaziny, tetrahydrofurany, dioxolany, tetrahydropyrany, dioxany, trioxany,
 20 tetrahydrothieny, 1-oxotetrahydrothieny, 1,1-dioxotetrahydrothieny

- 25 -

- tetrahydrothiopyran, 1-oxotetrahydrothiopyran, 1,1-dioxotetrahydrothiopyran, dithianyl, trithianyl, morpholinyl, oxathiolanyl, oxathianyl, thiomorpholinyl, thiazinanyl, 1-oxo-thiomorpholinyl, 1,1-dioxo-thiomorpholinyl, thiazolidinyl, pyrrolyl, imidazolyl, triazolyl, pyridyl, pyrimidinyl, pyrazinyl, pyridazinyl, triazinyl, thiazolyl, thiadiazolyl, thiadiazinyl, oxazolyl, isoxazolyl, oxadiazolyl, furazanyl, octahydropyrrolopyrrolyl, octahydropyrrolopyrrolyl, benzotriazolyl, dihydrobenzotriazolyl, indolyl, indolinyl, benzimidazolyl, 2,3-dihydrobenzimidazolyl, benzotriazolyl 2,3-dihydro benzotriazolyl quinolinyl, isoquinolinyl, cinnolinyl, phthalazinyl, quinazolinyl, quinoxalinyl, naphthyridinyl, pteridinyl, benzodioxolyl, tetrahydrodioxolopyrrolyl, 1,5-dioxo-9-azaspiro[5.5]undecanyl or 8-oxa-3-azabicyclooctanyl; each of which is optionally substituted by up to 3 groups selected from R^{12} , R^{13} and R^{14} or
- (iv) C_{3-7} carbocyclyl; optionally substituted by up to 3 groups selected from R^{12} , R^{13} and R^{14} ;
- Further preferably R^8 is selected from
- (i) hydrogen, C_{1-6} alkyl, C_{2-6} alkenyl, halo C_{1-6} alkyl, hydroxy, cyano, C_{1-6} alkylS(O_n)-, -O- R^b , C_{1-4} alkoxy C_{1-4} alkyl, -C(O)- R^b , C(O)O- R^b , -NH-C(O)- R^b , N,N-di- C_{1-4} alkylamino, -S(O_n)NR b R c where R^b and R^c are independently selected from hydrogen and C_{1-6} alkyl, and n is 0, 1 or 2;
- preferably selected from: hydrogen, methyl, isopropyl, *t*-butyl, 1-methylethyl, allyl, fluoroethyl, hydroxy, cyano, ethylsulphonyl, methoxy, 1-methyl-2-methoxyethyl, acetyl, *t*-butoxycarbonyl, acetylamino, dimethylamino, diethylamino, (1-methylethyl)amino, isopropylamino or aminosulphonyl;
- (ii) -(Q)-aryl, wherein aryl is optionally substituted by up to 3 groups selected from R^{12} , R^{13} and R^{14} ;
- (iii) azetidiny, furanyl, tetrahydrofuranyl, tetrahydropyranyl, pyrrolidinyl, piperidinyl, piperazinyl, hexahydropyrimidinyl, morpholinyl, tetrahydrothienyl, 1,1-dioxotetrahydrothienyl, thiomorpholinyl, 1-oxo-thiomorpholinyl, 1,1-dioxo-thiomorpholinyl, imidazolyl, triazolyl, thienyl, thiazolyl, isoxazolyl, pyridyl, pyrimidinyl, pyrazinyl, tetrahydro-3aH-[1,3]dioxolo[4,5-*c*]pyrrolyl, 1,5-dioxo-9-azaspiro[5.5]undecanyl, 8-oxa-3-azabicyclo[3.2.1]octanyl, benzodioxolyl, 2,3-dihydrobenzotriazolyl, 1,2-dihydroquinolinyl or octahydropyrrolo[3,4-*c*]pyrrolyl;

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each of which is optionally substituted by up to 3 groups selected from R^{12} , R^{13} and R^{14} ; or

- (iv) C_{3-7} carbocyclyl, optionally substituted by up to 3 groups selected from R^{12} , R^{13} and R^{14} ;

5 Yet further preferably R^8 is selected from

- (i) phenyl optionally substituted by up to 3 groups selected from R^{12} , R^{13} and R^{14} or naphthyl;

- (ii) furanyl, tetrahydropyranyl, pyrrolidinyl, piperazinyl, morpholinyl, 1,1-dioxo-thiomorpholinyl, thienyl, triazolyl, pyridyl, pyrimidinyl, pyrazinyl,

10 tetrahydro-3aH-[1,3]dioxolo[4,5-c]pyrrolyl, benzodioxolyl, 1,2-dihydroquinolinyl or 2,3-dihydrobenzotriazolyl; each of which is optionally substituted by up to 3 groups selected from R^{12} , R^{13} and R^{14} ; or

- (iii) C_{3-7} carbocyclyl (preferably cyclohexyl or cyclopentyl, more preferably cyclohexyl) optionally substituted by up to 3 groups selected from R^{12} , R^{13} and R^{14} ;

15 Further preferably R^8 is selected from: phenyl, thienyl, pyridyl and benzodioxyl optionally substituted by up to 3 groups selected from R^{12} , R^{13} and R^{14} .

Most preferably R^8 is 1,3 benzodioxolyl.

In another embodiment of the invention R^8 is selected from piperidinyl or piperazinyl, azetidyl, imidazolyl and thiazolyl, each of which is optionally substituted by up to 3 groups
20 selected from R^{12} , R^{13} and R^{14} .

In a further embodiment of the invention preferably R^8 is selected from hydrogen, cyano, C_{1-4} alkyl (more preferably methyl), C_{2-6} alkynyl (more preferably 2-propynyl), hydroxy C_{1-6} alkyl (more preferably hydroxyethyl), C_{1-4} alkoxy C_{1-4} alkyl (more preferably methoxyethyl), halo C_{1-6} alkyl (more preferably fluoroethyl), C_{1-4} alkanoyl (more preferably formyl), C_{1-4} alkoxycarbonyl (more preferably butyloxycarbonyl), N,N-di- C_{1-4} alkylamino (more preferably N,N-dimethylaminoethyl and N,N-dimethylaminopropyl), C_{1-6} alkyl-S(O_n)- (more preferably ethylsulphonyl), cyclopentyl, phenyl, benzyl, cyanophenyl, pyrrolidinyl, pyrrolidinylethyl, imidazolyl, imidazolyl C_{1-6} alkyl (more preferably imidazolylethyl), thiazolyl, pyridyl, pyridyl C_{1-6} alkyl (more preferably pyridylmethyl) or pyrimidyl wherein a phenyl or
30 heterocyclyl ring is optionally substituted by C_{1-4} alkyl or halo.

When R^9 and/or R^{10} is a component of group G, R^9 and R^{10} are preferably independently selected from hydrogen, optionally substituted C_{1-6} alkyl, optionally substituted aryl, optionally substituted aryl C_{1-6} alkyl or R^9 and R^{10} forms C_{3-7} cycloalkyl or heterocyclyl.

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Further preferably hydrogen or C₁₋₄alkyl. Most preferably hydrogen or methyl. Most preferably both **R**⁹ and **R**¹⁰ are methyl.

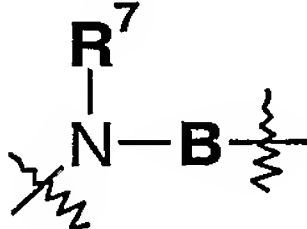
When **R**⁹ and/or **R**¹⁰ is a component of group **R**¹⁸, **R**⁹ and **R**¹⁰ are preferably independently selected from hydrogen, optionally substituted C₁₋₆alkyl, optionally substituted
5 aryl, optionally substituted arylC₁₋₆alkyl or **R**⁹ and **R**¹⁰ forms C₃₋₇cycloalkyl or heterocyclyl. Further preferably when **R**⁹ is a component of group **R**¹⁸, **R**⁹ is preferably heterocyclyl. Most preferably pyrrolidinyl, 7-azabicyclo[2.2.1]hept-7-yl or 3-azabicyclo[3.2.2]nonyl.

Preferably **R**¹⁷ is hydrogen, hydroxy, cyano or is absent. Most preferably **R**¹⁷ is absent.

Preferably **R**¹⁸ is selected from hydrogen, **R**⁹N(**R**¹⁰)C(O)-, **R**⁹C(O)-, **R**⁹OC(O)- or
10 **R**^{18a}-C(**R**⁹**R**¹⁰)- wherein **R**^{18a} is **R**⁹N(**R**¹⁰)C(O)-. Further preferably **R**⁹C(O)-. Most preferably **R**⁹C(O)- wherein **R**⁹ is heterocyclyl.

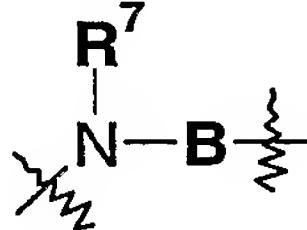
Preferably **A** is selected from a direct bond, optionally substituted C₁₋₅alkylene, carbonyl or -C(O)-C(**R**^d**R**^d)-, wherein **R**^d is independently selected from a direct bond hydrogen and C₁₋₂alkyl. Further preferably **A** is selected from C₁₋₅alkylene optionally
15 substituted with C₁₋₄alkyl, carbonyl or carbonylmethyl. Yet further preferably **A** is a direct bond methylene. Most preferably methylene.

Preferably **B** is selected from optionally substituted C₁₋₆alkylene, optionally substituted C₃₋₆alkenylene, -(C₁₋₅alkyl)_{aa}-O-(C₁₋₅alkyl)_{bb}-, -(C₁₋₅alkyl)_{aa}-C(O)-(C₁₋₅alkyl)_{bb}-,

- (CH₂)_{s1}-C(O)N(**R**⁹)-(CH₂)_{s2}-, or the group  forms an optionally substituted

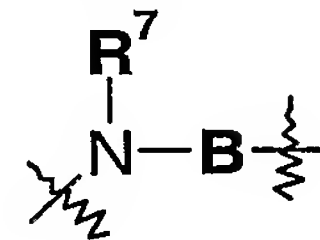
20 C₄₋₇heterocyclic ring, wherein **aa** and **bb** are independently 0 to 1 and, wherein the combined length of (C₁₋₅alkyl)_{aa} and (C₁₋₅alkyl)_{bb} is less than or equal to C₅alkyl.

More preferably **B** is C₁₋₆alkylene, C₃₋₆alkenylene, -(C₁₋₅alkyl)_{aa}-O-(C₁₋₅alkyl)_{bb}-,

- (C₁₋₅alkyl)_{aa}-C(O)-(C₁₋₅alkyl)_{bb}-, -(CH₂)_{s1}-C(O)N(**R**⁹)-, or the group  forms an
optionally substituted saturated C₄₋₇heterocyclic ring, wherein **aa** and **bb** are independently 0
25 or 1 and wherein the combined length of (C₁₋₅alkyl)_{aa}, (C₁₋₅alkyl)_{bb} is less than or equal to C₅alkyl and wherein C₁₋₆alkylene is optionally substituted by hydroxy.

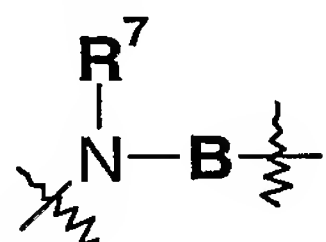
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Further preferably **B** is unsubstituted C₁₋₆alkylene, C₃₋₆alkenylene



-(C₁₋₅alkyl)_{aa}-O-(C₁₋₅alkyl)_{bb}-, -(C₁₋₅alkyl)_{aa}-C(O)- or the group forms an optionally substituted saturated C₄₋₇heterocyclic ring selected from: azetidiny, pyrrolidiny, pyrazoliny, pyrazolidiny, imidazoliny, imidazolidiny, piperidiny, piperaziny, 5 hexahydropyrimidiny, hexahydropyridaziny, hexahydrotriaziny, tetrahydrotriaziny, dihydrotriaziny, morpholiny, thiomorpholiny, thiazinany, thiazolidiny, 1,5-dioxa-9-azaspiro[5.5]undecany or octahydropyrrolopyrroly, wherein the optional substituents are selected from: cyano, hydroxy, oxo, C₁₋₄alkyl, C₁₋₄alkoxy, C₁₋₄alkanoyl, **R**⁹OC(O)(CH₂)_w-, **R**⁹**R**¹⁰NC(O)(CH₂)_w- or halo, wherein w is an integer between 0 and 4 and **R**⁹ and **R**¹⁰ are as 10 defined above. Further preferably the optional substituents are selected from: cyano, hydroxy, oxo, C₁₋₄alkyl, C₁₋₄alkoxy and C₁₋₄alkanoyl, **aa** and **bb** are independently 0 or 1, wherein the combined length of (C₁₋₅alkyl)_{aa} and (C₁₋₅alkyl)_{bb} is less than or equal to C₅alkyl and wherein C₁₋₆alkylene is optionally substituted by hydroxy.

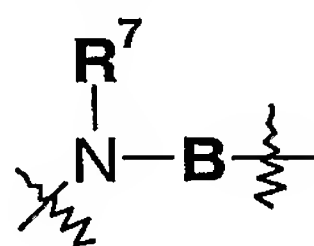
Yet further preferably **B** is selected from: methylene, ethylene, propylene, propyl-2-ene, 15 butylene, pentylene, 2-propenyl, propoxy, ethoxyethyl, methylcarbonyl or methylcarbonylamino.



or the group forms an C₄₋₇heterocyclic ring selected from: pyrrolidiny, piperidiny, or piperaziny, wherein the optional substituents are selected from oxo.

Most preferably **B** is selected from ethylene or butylene.

20 In another embodiment of the invention preferably **B** is selected from optionally



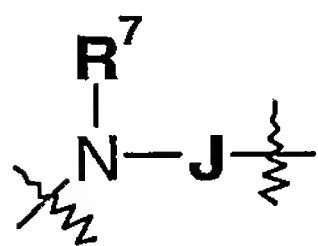
substituted C₁₋₆alkylene or the group forms a C₅₋₇heterocyclic ring. Preferably unsubstituted C₆alkylene or a C₅₋₇heterocyclic saturated ring. Most preferably methylene, ethylene, propylene, butylene or piperaziny.

Preferably **G** is a direct bond, -O- or -C(**R**⁹**R**¹⁰)-. More preferably -C(**R**⁹**R**¹⁰)-. Most 25 preferably -C(CH₃)₂-.

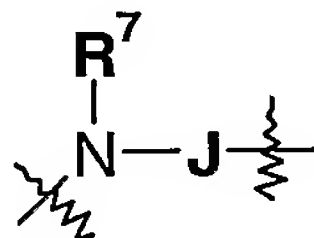
Preferably **M** is -CH₂-O-.

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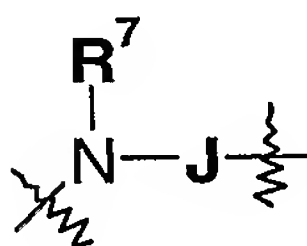
When \mathbf{R}^3 is selected from a group of Formula (IIc) or Formula (IId) then the group



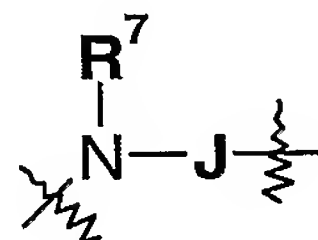
preferably forms an optionally substituted heterocyclic ring containing 4-7 carbons atoms.



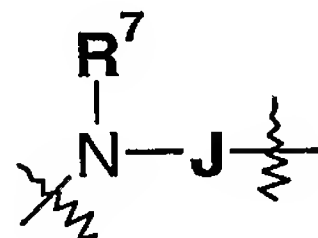
More preferably the group forms an optionally substituted saturated C_{4-7} heterocyclic ring.



Further preferably the group forms an optionally substituted saturated C_{4-7} heterocyclic ring selected from: azetidiny, pyrrolidiny, pyrazoliny, pyrazolidiny, imidazoliny, imidazolidiny, piperidiny, piperaziny, hexahydropyrimidiny, hexahydropyridaziny, hexahydrotriaziny, tetrahydrotriaziny, dihydrotriaziny, morpholiny, thiomorpholiny, thiazinany, thiazolidiny or octahydropyrrolopyrroly, wherein the optional substituents are selected from oxo.



Further preferably the group forms an optionally substituted saturated C_{4-7} heterocyclic ring selected from: pyrrolidiny, piperidiny or piperaziny, wherein the optional substituents are selected from oxo.



Most preferably the group forms an optionally substituted saturated C_{4-7} heterocyclic ring selected from: piperaziny.

Preferably \mathbf{K} is selected from: $-(\text{CH}_2)_s-$, $-(\text{CH}_2)_s\text{-O-}(\text{CH}_2)_s-$, $-(\text{CH}_2)_s\text{-C(O)-}(\text{CH}_2)_s-$, $-(\text{CH}_2)_s\text{-N}(\mathbf{R}^{18})\text{-(CH}_2)_s-$, $-(\text{CH}_2)_s\text{-C(O)N}(\mathbf{R}^{18})\text{-(CH}_2)_s-$, $-(\text{CH}_2)_s\text{-N}(\mathbf{R}^{18})\text{C(O)-}(\text{CH}_2)_s-$, $-(\text{CH}_2)_s\text{-S(O)}_2\text{N}(\mathbf{R}^{18})\text{-(CH}_2)_s-$, or $-(\text{CH}_2)_s\text{-NHS(O)}_2\text{-(CH}_2)_s-$,

wherein s is independently selected from 0, 1, 2, 3 or 4, \mathbf{R}^{18} is selected from hydrogen or C_{1-4} alkyl (preferably hydrogen) and the $-(\text{CH}_2)_s-$ group is optionally substituted by hydroxy or C_{1-4} alkyl.

- 30 -

More preferably **K** is selected from: $-(\text{CH}_2)_s-$, $-(\text{CH}_2)_s\text{-O-}(\text{CH}_2)_s-$, $-(\text{CH}_2)_s\text{-C(O)-}$, $-\text{C(O)-}(\text{CH}_2)_s-$, $-(\text{CH}_2)_s\text{-N(R}^{18})-$, $-(\text{CH}_2)_s\text{-C(O)N(R}^{18})-$, $-(\text{CH}_2)_s\text{-N(R}^{18})\text{C(O)-}(\text{CH}_2)_s-$, $-(\text{CH}_2)_s\text{-S(O)}_2\text{N(R}^{18})-$ or $-(\text{CH}_2)_s\text{-NHS(O)}_2-$,

wherein *s* is independently selected from 0, 1, 2, 3 or 4, **R**¹⁸ is selected from hydrogen or

- 5 **C**₁₋₄alkyl (preferably hydrogen or methyl) and the $-(\text{CH}_2)_s-$ group is optionally substituted by hydroxy or **C**₁₋₄alkyl.

More preferably **K** is selected from: methylene, ethylene, propylene, butylene, oxy, 2-hydroxypropylene, carbonyl, methylcarbonyl, ethylcarbonyl, (methyl)methylcarbonyl, (ethyl)methylcarbonyl, carbonylmethylene, carbonylethylene, ethoxyethylene, amino,

- 10 2-hydroxypropylamino, carbonylamino, methylcarbonylamino, N-methyl-methylcarbonylamino, aminocarbonyl, methylaminocarbonyl, methylaminocarbonylmethyl, propylsulphonylamino or methylaminosulphonyl.

Further preferably **K** is selected from: methylene, ethylene, propylene, butylene carbonyl, methylcarbonyl or N-methylmethylcarbonylamino.

- 15 Most preferably **K** is selected from: methylcarbonyl and N-methylmethylcarbonylamino.

Preferably optional substituents on heterocyclyl groups in **R**⁸, **R**⁹, **R**¹⁰, **R**¹⁸ and **R**¹⁹ or on heterocyclyl groups formed when **R**¹⁷ and **R**¹⁸ together form a heterocyclic ring are selected from: optionally substituted **C**₁₋₆alkyl, **C**₁₋₆alkoxy, **C**₁₋₆alkanoyl, optionally substituted

- 20 **C**₂₋₆alkenyl, cyano, nitro, **C**₁₋₃perfluoroalkyl, **C**₁₋₃perfluoroalkoxy, optionally substituted aryl, optionally substituted aryl**C**₁₋₆alkyl, **R**⁹**O**(**CH**₂)_{*p*}-, **R**⁹**C**(**O**)**O**(**CH**₂)_{*w*}-, **R**⁹**O****C**(**O**)(**CH**₂)_{*w*}-, **R**¹⁶**S**(**O**_{*n*})(**CH**₂)_{*w*}-, **R**⁹**R**¹⁰**N****C**(**O**)(**CH**₂)_{*w*}- or halo; wherein *w* is an integer between 0 and 4 and *p*, **R**⁹, **R**¹⁰ and **R**¹⁶ are as defined above.

- 25 More preferably optional substituents on **R**⁸ are selected from: cyano, hydroxy, oxo, nitro, halo, trifluoromethyl, **C**₁₋₄alkyl, **C**₁₋₄alkoxy, **C**₁₋₄alkanoyl, **R**⁹**O****C**(**O**)(**CH**₂)_{*w*}-, **R**⁹**R**¹⁰**N**(**CH**₂)_{*w*}-, **R**⁹**R**¹⁰**N****C**(**O**)(**CH**₂)_{*w*}-, **R**⁹**R**¹⁰**N****C**(**O**)(**CH**₂)_{*w*}-, **R**⁹**R**¹⁰**N****C**(**O**)**N**(**R**⁹)(**CH**₂)_{*w*}-, **R**⁹**O****C**(**O**)**N**(**R**⁹)(**CH**₂)_{*w*}-, or halo, wherein *w* is an integer between 0 and 4 and **R**⁹ and **R**¹⁰ are selected from: hydrogen, **C**₁₋₄alkyl, **C**₁₋₄alkylsulphonyl and **C**₃₋₇carbocyclyl.

- 30 Further preferably optional substituents on **R**⁸ are selected from: cyano, hydroxy, oxo, amino, N,N-di**C**₁₋₄alkylamino, N,N-di**C**₁₋₄alkylamino**C**₁₋₄alkyl, N'-**C**₁₋₄alkylureido, N-**C**₁₋₄alkylsulphonylamino, N,N-di-**C**₁₋₄alkylsulphonylamino, nitro, halo, trifluoromethyl, **C**₁₋₄alkyl, **C**₁₋₄alkoxy, **C**₁₋₄alkanoyl, **C**₁₋₄alkoxycarbonylamino and **C**₃₋₇carbocyclylcarbonylamino.

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More preferably optional substituents on R^8 are selected from: cyano, oxo, methyl, *t*-butyl, methoxy, acetyl, amino, N,N-dimethylamino, N'-isopropylureido, N'-cyclohexylureido, N-methylsulphonylamino, N,N-dimethylsulphonylamino, nitro, chloro, fluoro, trifluoromethyl, isopropoxycarbonylamino and cyclopentylcarbonylamino.

5 Most preferably optional substituents on R^8 are selected from: methoxy, fluoro, methylsulphonylamino and isopropoxycarbonylamino.

In a further embodiment of the invention optional substituents on R^8 are selected from: C₁₋₄alkoxy, fluoro, C₁₋₄alkylsulphonylamino, C₁₋₄alkanoylamino, C₁₋₄alkylureido and C₁₋₄alkoxycarbonylamino.

10 In a further embodiment of the invention when R^8 is phenyl then R^8 is preferably substituted and when R^8 is a heterocyclic ring R^8 is preferably unsubstituted.

Preferably the optional substituents on alkyl, alkenyl, alkynyl, cycloalkyl and aryl groups are independently selected from C₁₋₆alkyl, C₁₋₆alkoxy, C₃₋₇cycloalkyl, optionally substituted aryl, optionally substituted arylC₁₋₆alkyl, hydroxy, oxo, cyano, C₁₋₆alkoxy, halo
15 (preferably fluoro), $R^{16}S(O_n)(CH_2)_w-$, $R^9OC(O)-$, optionally substituted arylC₁₋₃alkoxy wherein R^9 is as defined above.

Preferably the optional substituents on optionally substituted aryl and arylC₁₋₆alkyl groups are selected from: optionally substituted C₁₋₆alkyl, optionally substituted C₂₋₆alkenyl, cyano, nitro, halo (preferably fluoro), C₁₋₃perfluoroalkyl, C₁₋₃perfluoroalkoxy, optionally
20 substituted aryl, optionally substituted arylC₁₋₆alkyl, $R^9O(CH_2)_p-$, $R^9C(O)O(CH_2)_w-$, $R^9OC(O)(CH_2)_w-$, $R^{16}S(O_n)(CH_2)_w-$, $R^9R^{10}NC(O)(CH_2)_w-$ or halo; wherein w is an integer between 0 and 4 and n, R^9 and R^{10} are as defined above.

In preferences for heterocyclyl in R^8 the nitrogen atoms contained in R^8 heteroaromatic rings exist either as drawn or, where chemically allowed, in their oxidised (N→O, N-OH)
25 state.

Where optional substitution is mentioned at various places the optional substituents also comprise the following definition which refers to one, two, three or more optional substituents. Unless otherwise indicated above (i.e., where a list of optional substituents is specifically listed within a definition), each substituent can be independently selected from
30 C₁₋₈alkyl (eg, C₂₋₆alkyl, and most preferably methyl, ethyl or *tert*-butyl); C₃₋₈cycloalkoxy, preferably cyclopropoxy, cyclobutoxy or cyclopentoxy; C₁₋₆alkoxy, preferably methoxy or C₂₋₄alkoxy; halo, preferably Cl or F; Hal₃C-, Hal₂CH-, HalCH₂-, Hal₃CO-, Hal₂CHO or HalCH₂O, wherein Hal represents halo (preferably F); R^gCH_2O- , $R^hC(O)N(R)-$, $R^hSO_2N(R)-$ or

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$\mathbf{R}^g\text{-}\mathbf{R}^h\text{N-}$, wherein \mathbf{R}^g and \mathbf{R}^h independently represent hydrogen or C_{1-8} alkyl (preferably methyl or C_{2-6} alkyl or C_{2-4} alkyl), or $\mathbf{R}^g\text{-}\mathbf{R}^h\text{N-}$ represents an optionally substituted C_{3-8} , preferably C_{3-6} , heterocyclic ring optionally containing from 1 to 3 further heteroatoms independently selected from O, N and S; hydrogen; or $\mathbf{R}^k\text{C(O)O-}$ or $\mathbf{R}^k\text{C(O)-}$, \mathbf{R}^k representing

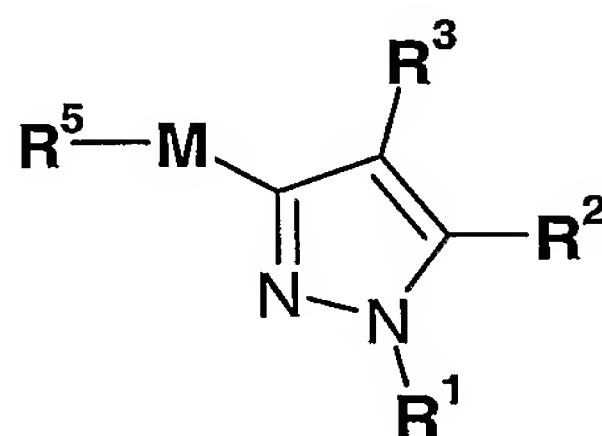
5 hydrogen, optionally substituted phenyl or C_{1-6} alkyl (preferably methyl, ethyl, *iso*-propyl or *tert*-butyl). For optional substitution of the heterocyclic ring represented by $\mathbf{R}^g\text{-}\mathbf{R}^h\text{N-}$, at least one (eg, one, two or three) substituents may be provided independently selected from

C_{1-6} alkyl (eg, C_{2-4} alkyl, more preferably methyl); phenyl; $\text{CF}_3\text{O-}$; $\text{F}_2\text{CHO-}$; C_{1-8} alkoxy, preferably methoxy, ethoxy or C_{3-6} alkoxy; C_{1-8} alkoxy C(O) , preferably methoxycarbonyl,

10 ethoxycarbonyl, *tert*-butoxycarbonyl or C_{3-6} alkoxy C(O)- ; phenoxycarbonyl; phenoxy; C_{1-8} alkanoyl, preferably acetyl, ethanoyl or C_{3-6} alkylanoyl; carboxy; C_{1-8} alkyl $\text{S(O}_{\mathbf{nn}}\text{)}$ wherein \mathbf{nn} is an integer between 0 and 2, preferably methylthio, ethylthio, C_{3-6} alkylthio, methylsulphinyl, ethylsulphinyl, C_{3-6} alkylsulphinyl, methylsulphonyl, ethylsulphonyl or C_{3-6} alkylsulphonyl; hydroxy; halo (eg, F, Cl or Br); $\mathbf{R}^m\mathbf{R}^n\text{N-}$ where \mathbf{R}^m and \mathbf{R}^n are

15 independently hydrogen or C_{1-6} alkyl (preferably C_{2-4} alkyl, more preferably methyl, most preferably $\mathbf{R}^m=\mathbf{R}^n=\text{methyl}$); and nitro.

According to a further aspect of the invention there is provided a compound of Formula (Ib)



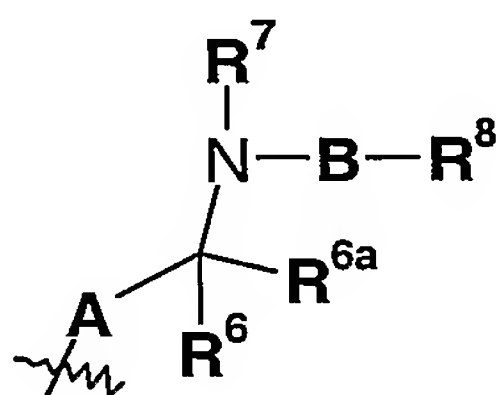
Formula (Ib)

wherein:

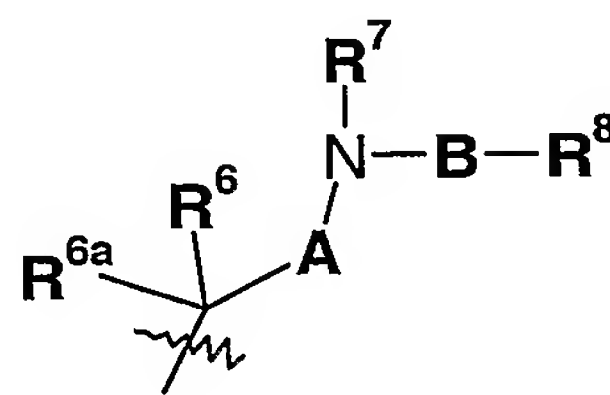
\mathbf{R}^1 represents hydrogen or unsubstituted C_{1-6} alkyl;

\mathbf{R}^2 represents optionally substituted phenyl;

\mathbf{R}^3 is selected from a group of Formula (IIa) to Formula (IId):

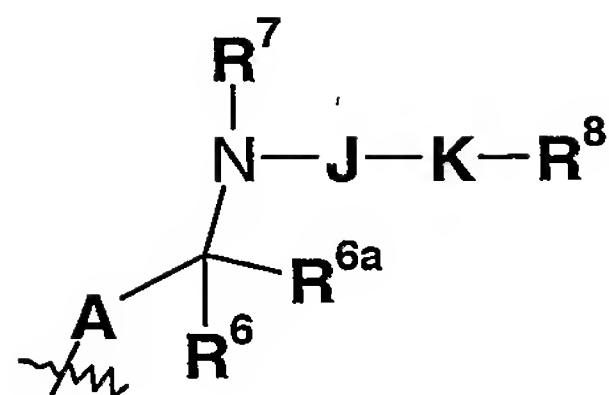


Formula (IIa)

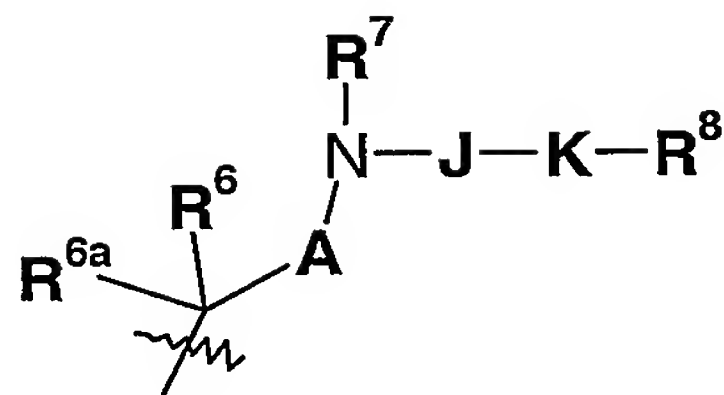


Formula (IIb)

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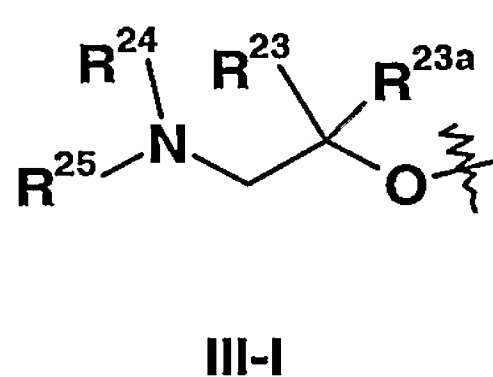
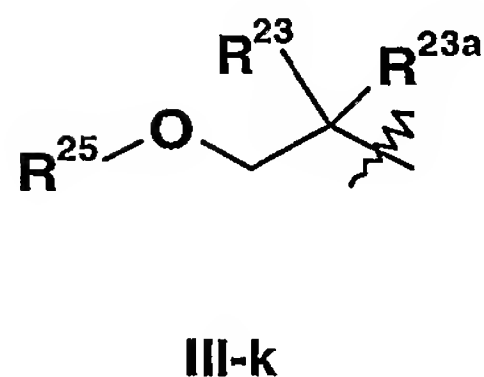
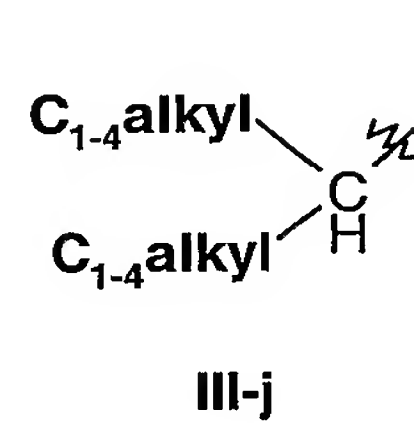
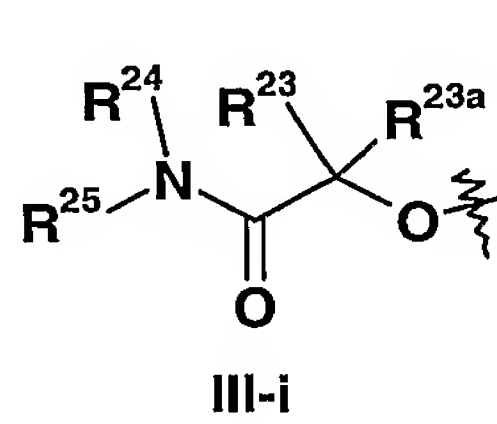
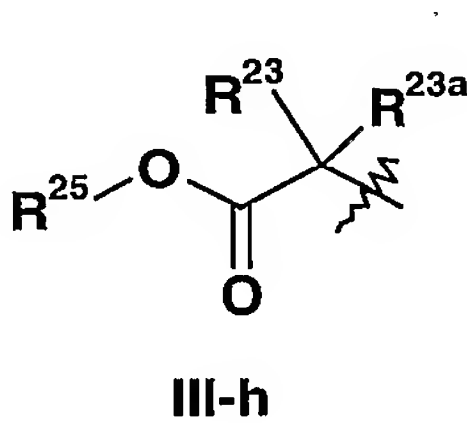
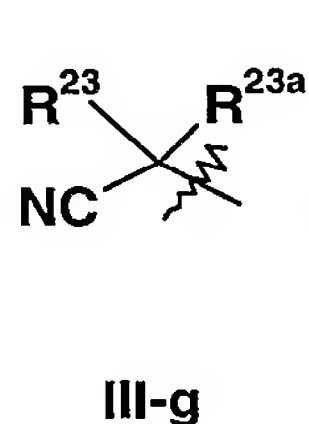
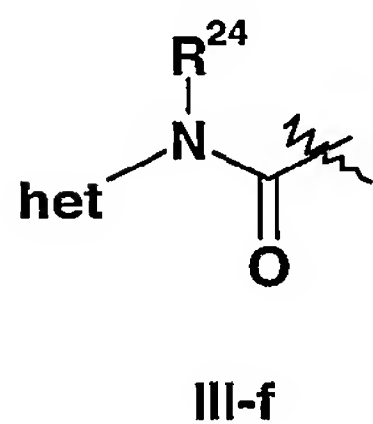
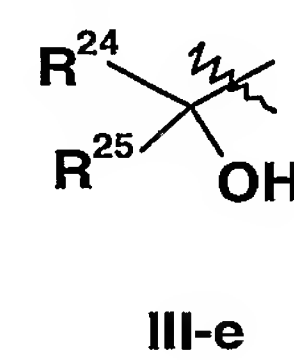
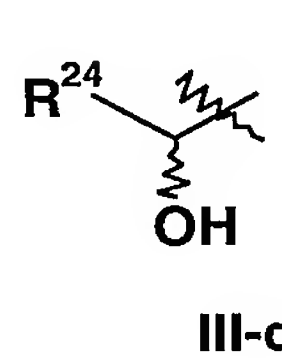
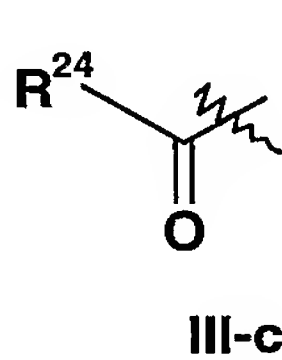
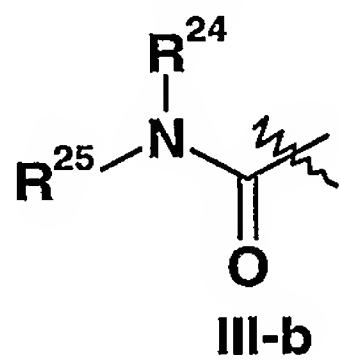
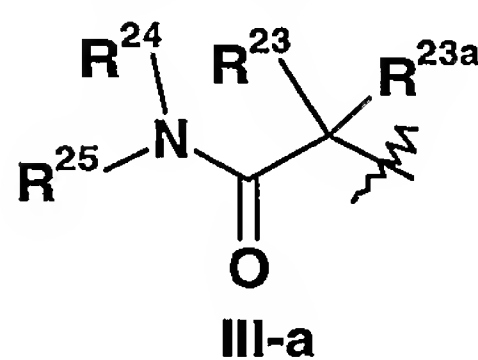


Formula (IIc)



Formula (IId)

R^5 is selected from a one of a group of Formula III-a to III-l:



5 wherein:

het represents an optionally substituted 3- to 8- membered heterocyclic ring containing from 1 to 4 heteroatoms independently selected from O, N and S;

R^{23} and R^{23a} are independently selected from:

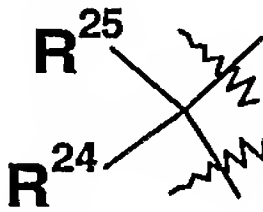
- (i) hydrogen or optionally substituted C_{1-8} alkyl; or
- 10 (ii) R^{23} and R^{23a} together with the carbon to which they are attached form an optionally substituted 3 to 7-membered cycloalkyl ring;

R^{24} and R^{25} are selected from:

- (i) R^{24} selected from hydrogen; optionally substituted C_{1-8} alkyl; optionally substituted aryl; $-R^d$ -Ar, where R^d represents C_{1-8} alkylene and Ar represents optionally substituted aryl; and optionally substituted 3- to 8- membered heterocyclic ring optionally containing from 1 to 3 further heteroatoms independently selected from O, N and S; and R^{25} is selected from hydrogen; optionally substituted C_{1-8} alkyl and optionally substituted aryl;
- 15

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- (ii) wherein the group of Formula (III) represents a group of Formula **III-a**, **III-b** or **III-i**, then the group $\text{NR}^{24}(-\text{R}^{25})$ represents an optionally substituted 3- to 8-membered heterocyclic ring optionally containing from 1 to 3 further heteroatoms independently selected from O, N and S; or

- 5 (iii) wherein the group of Formula (III) represents structure **III-e**,  represents an optionally substituted 3- to 8- membered heterocyclic ring optionally containing from 1 to 4 heteroatoms independently selected from O, N and S;

R^6 and R^{6a} are independently selected from hydrogen, fluoro or optionally substituted
10 C_{1-6} alkyl.

R^7 is selected from: hydrogen or C_{1-4} alkyl;

R^8 is selected from

- (i) hydrogen, C_{1-6} alkyl, C_{2-6} alkenyl, halo C_{1-6} alkyl, hydroxy, cyano, C_{1-6} alkyl $\text{S}(\text{O}_n)-$,
15 $-\text{O}-\text{R}^b$, C_{1-4} alkoxy C_{1-4} alkyl, $-\text{C}(\text{O})-\text{R}^b$, $\text{C}(\text{O})\text{O}-\text{R}^b$, $-\text{NH}-\text{C}(\text{O})-\text{R}^b$,
N,N-di- C_{1-4} alkylamino or $-\text{S}(\text{O}_n)\text{NR}^b\text{R}^c$
where R^b and R^c are independently selected from hydrogen and C_{1-6} alkyl, and n is
0, 1 or 2;
- (ii) -aryl, , optionally substituted by up to 4 substituents selected from R^{12} , R^{13} and R^{14} ;
- (iii) C_{4-7} heterocyclyl, optionally substituted by up to 4 substituents selected from R^{12} ,
20 R^{13} and R^{14} ; or
- (iv) C_{3-7} carbocyclyl, , optionally substituted by up to 4 substituents selected from R^{12} ,
 R^{13} and R^{14} ;

R^9 and R^{10} are independently selected from: hydrogen, hydroxy, optionally substituted
 C_{1-6} alkyl, optionally substituted aryl, optionally substituted aryl C_{1-6} alkyl, an optionally
25 substituted carbocyclic ring of 3-7 atoms, optionally substituted heterocyclyl, optionally
substituted heterocyclyl C_{1-6} alkyl or R^9 and R^{10} taken together can form an optionally
substituted ring of 3-9 atoms or R^9 and R^{10} taken together with the carbon atom to
which they are attached form a carbonyl group;

R^{12} is selected from: hydrogen, hydroxy, $\text{R}^{17}\text{R}^{18}\text{N}(\text{CH}_2)_{cc-}$, $\text{R}^{17}\text{R}^{18}\text{NC}(\text{O})(\text{CH}_2)_{cc-}$,
30 optionally substituted C_{1-6} alkyl- $\text{C}(\text{O})\text{N}(\text{R}^9)(\text{CH}_2)_{cc-}$, optionally substituted
 C_{1-6} alkyl- $\text{SO}_2\text{N}(\text{R}^9)-$, optionally substituted aryl- $\text{SO}_2\text{N}(\text{R}^9)-$,
 C_{1-3} perfluoroalkyl- $\text{SO}_2\text{N}(\text{R}^9)-$; optionally substituted C_{1-6} alkyl- $\text{N}(\text{R}^9)\text{SO}_2-$, optionally

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substituted aryl-N(**R**⁹)SO₂-, C₁₋₃perfluoroalkyl-N(**R**⁹)SO₂- optionally substituted C₁₋₆alkanoyl-N(**R**⁹)SO₂-; optionally substituted aryl-C(O)N(**R**⁹)SO₂-, optionally substituted C₁₋₆alkyl-S(O_n) -, optionally substituted aryl-S(O_n) - , C₁₋₃perfluoroalkyl-, C₁₋₃perfluoroalkoxy, optionally substituted C₁₋₆alkoxy, carboxy, halo, nitro or cyano;

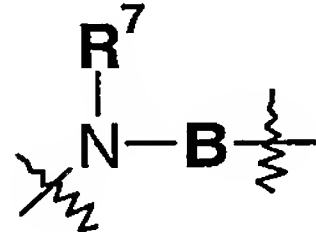
5 **R**¹³ and **R**¹⁴ are independently selected from: hydrogen, hydroxy, oxo, optionally substituted C₁₋₆alkyl, optionally substituted C₁₋₆alkanoyl, optionally substituted C₂₋₆alkenyl, cyano, nitro, C₁₋₃perfluoroalkyl-, C₁₋₃perfluoroalkoxy, optionally substituted aryl, optionally substituted arylC₁₋₆alkyl, **R**⁹O(CH₂)_s-, **R**⁹(O)O(CH₂)_s-, **R**⁹OC(O)(CH₂)_s-, **R**¹⁶S(O_n)(CH₂)_s-, **R**⁹**R**¹⁰NC(O)(CH₂)_s- or halo; **A** is selected from
10 optionally substituted C₁₋₅alkylene, carbonyl or -C(O)-C(**R**^d**R**^d)-, wherein **R**^d is independently selected from hydrogen and C₁₋₂alkyl.;

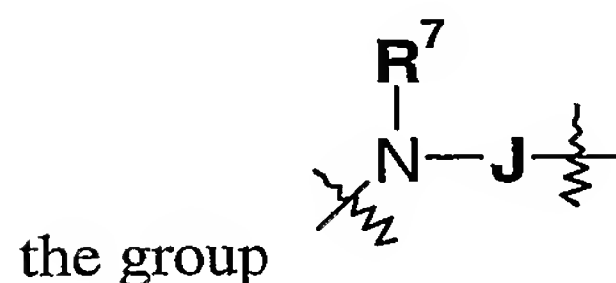
R¹⁷ is independently selected from: hydrogen, hydroxy, cyano or optionally substituted C₁₋₆alkyl;

R¹⁸ is a group of formula **R**^{18a}-C(**R**⁹**R**¹⁰)₀₋₁- wherein **R**^{18a} is selected from: **R**¹⁹OC(O)-, **R**⁹**R**¹⁰NC(O)-, **R**⁹**R**¹⁰N-, **R**⁹C(O)-, **R**⁹C(O)N(**R**¹⁰)-, **R**⁹**R**¹⁰NC(O)-, **R**⁹**R**¹⁰NC(O)N(**R**¹⁰)-, **R**⁹SO₂N(**R**¹⁰)-, **R**⁹**R**¹⁰NSO₂N(**R**¹⁰)-, **R**⁹C(O)O-, **R**⁹OC(O)-, **R**⁹**R**¹⁰NC(O)O-, **R**⁹O-, **R**⁹S(O_n)-, **R**⁹**R**¹⁰NS(O_n) -, hydrogen, optionally substituted C₁₋₆alkyl, optionally substituted heterocyclyl;

or **R**¹⁷ and **R**¹⁸ when taken together form an optionally substituted carbocyclic ring of 3-
20 7 atoms or optionally substituted heterocyclyl;

R¹⁹ is selected from: hydrogen, optionally substituted C₁₋₆alkyl, optionally substituted aryl, optionally substituted arylC₁₋₆alkyl, optionally substituted C₃₋₇cycloalkyl, optionally substituted heterocyclyl or optionally substituted heterocyclylC₁₋₆alkyl;

B is selected from optionally substituted C₁₋₆alkylene or the group  forms an
25 optionally substituted C₄₋₇heterocyclic ring, wherein the optional substituents are selected from **R**¹², **R**¹³ and **R**¹⁴;



preferably forms an optionally substituted heterocyclic ring containing 4-7 carbons atoms, wherein the optional substituents are selected from **R**¹², **R**¹³ and **R**¹⁴;

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K is selected from: a direct bond, $-(CH_2)_{s1}-$, $-(CH_2)_{s2}-O-(CH_2)_{s-}$, $-(CH_2)_{s1}-C(O)-(CH_2)_{s2}-$,
 $-(CH_2)_{s1}-S(O_n)-(CH_2)_{s2}-$, $-(CH_2)_{s1}-N(R^{18})-(CH_2)_{s2}-$, $-(CH_2)_{s1}-C(O)N(R^9)-(CH_2)_{s2}-$,
 $-(CH_2)_{s1}-N(R^9)C(O)-(CH_2)_{s2}-$, $-(CH_2)_{s1}-N(R^9)C(O)N(R^9)-(CH_2)_{s2}-$,
 $-(CH_2)_{s1}-OC(O)-(CH_2)_{s2}-$, $-(CH_2)_{s1}-C(O)O-(CH_2)_{s2}-$, $-(CH_2)_{s1}-N(R^9)C(O)O-(CH_2)_{s2}-$,
5 $-(CH_2)_{s1}-OC(O)N(R^9)-(CH_2)_{s2}-$, $-(CH_2)_{s1}-OS(O_n)-(CH_2)_{s2}-$, or
 $-(CH_2)_{s1}-S(O_n)-O-(CH_2)_{s2}-$, $-(CH_2)_{s1}-S(O)_2N(R^9)-(CH_2)_{s2}-$,
 $-(CH_2)_{s1}-N(R^9)S(O)_2-(CH_2)_{s2}-$; wherein the $-(CH_2)_{s1}-$ and $-(CH_2)_{s2}-$ groups are
independently optionally substituted by hydroxy, fluoro, cyano, carbamoyl, C_{1-4} alkyl
and C_{1-4} alkoxy,

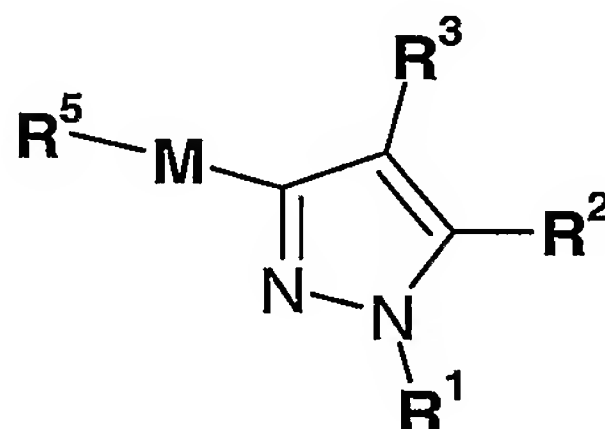
10 **n** is an integer from 0 to 2;

s1 and **s2** are independently selected from an integer from 0 to 4, and

s1+s2 is less than or equal to 4;

or a salt, pro-drug or solvate thereof.

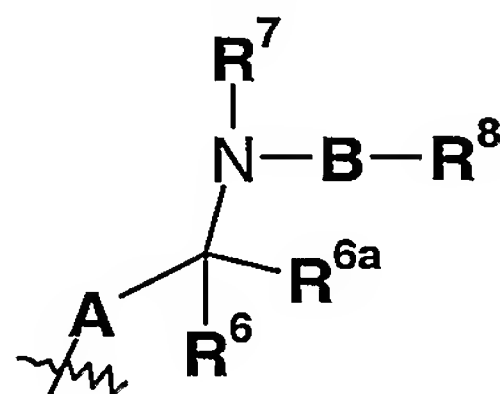
According to a further aspect of the invention there is provided a compound of Formula
15 (Ic)



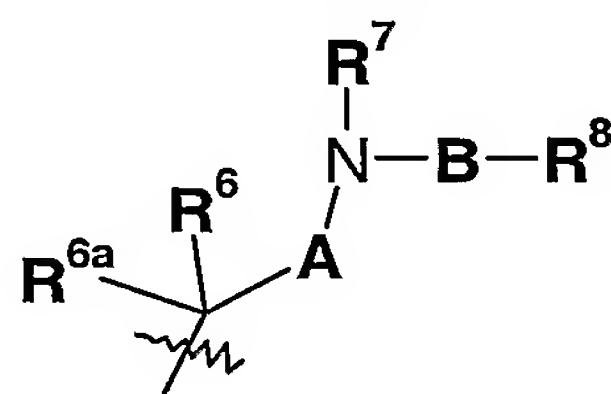
Formula (Ic)

wherein

R³ is selected from a group of Formula (IIa) or Formula (IIb):



Formula (IIa)



Formula (IIb)

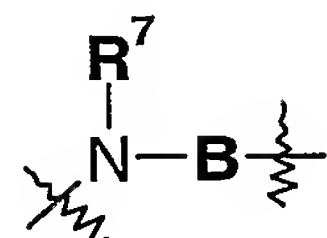
and **R¹**, **R²**, **R⁵**, **R⁶**, **R^{6a}**, **R⁷**, **R⁸**, **A**, **B** and **M** are as defined above;

or salt, solvate or pro-drug thereof.

A further preferred group of compounds of the invention comprises a compound of
25 Formula (Ic), wherein:

A is optionally substituted C_{1-5} alkylene;

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B is selected from optionally substituted C₁₋₆alkylene or the group forms a ring containing C₅₋₇heterocyclic ring;

M is -CH₂-O-;

R¹ is hydrogen or C₁₋₄alkyl;

5 **R**⁶ and **R**^{6a}, are independently selected from hydrogen and optionally substituted C₁₋₆alkyl;

R⁷ is selected from: hydrogen or C₁₋₄alkyl;

R⁸ is selected from hydrogen, cyano, C₁₋₆alkyl, haloC₁₋₆alkyl, C₂₋₆alkynyl, C₁₋₆alkanoyl, C₁₋₄alkoxyC₁₋₄alkyl, C₁₋₆alkoxycarbonyl, N,N-di-C₁₋₄alkylamino, aryl, arylC₁₋₆alkyl, C₃₋₇cycloalkyl, C₃₋₇cycloalkylC₁₋₆alkyl, heterocyclyl, heterocyclylC₁₋₆alkyl, or

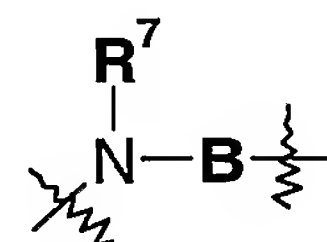
10 heterocyclylcarbonylC₁₋₄alkyl wherein aryl and heterocyclyl rings are optionally substituted by cyano and C₁₋₄alkyl; and

R² and **R**⁵; are as defined above

or salt, solvate or pro-drug thereof.

A further preferred group of compounds of the invention comprises a compound of
15 Formula (Ic), wherein:

A is optionally substituted C₁₋₅alkylene;



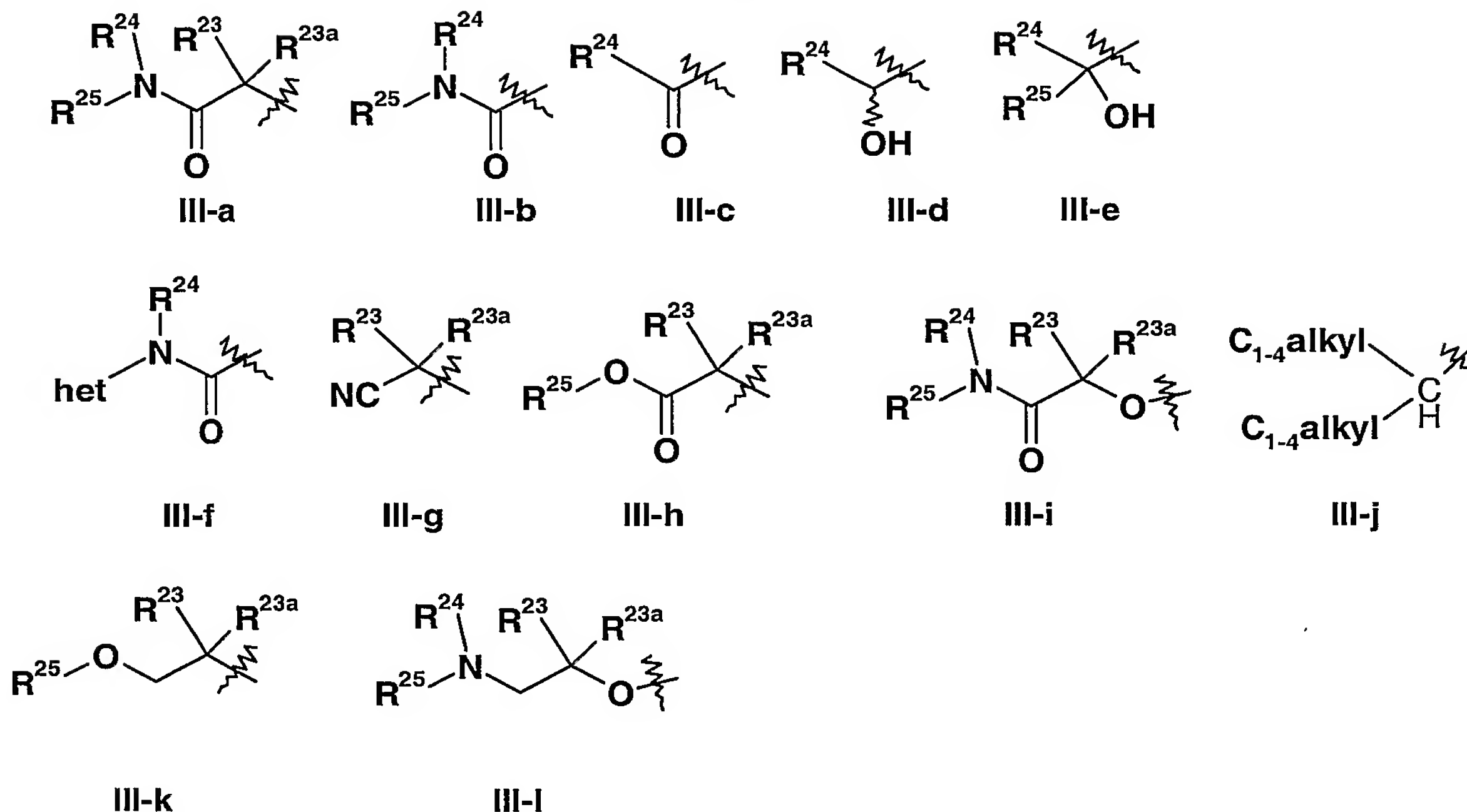
B is selected from optionally substituted C₁₋₆alkylene or the group forms a ring containing C₅₋₇heterocyclic ring;

R¹ is hydrogen or C₁₋₄alkyl, preferably hydrogen;

20 **R**² is an optionally substituted monocyclic aromatic ring structure, preferably optionally substituted phenyl, most preferably 3,5-dimethylphen-1-yl;

R⁵ is a group of Formula (III) wherein the group of Formula (III) is selected from a group of Formula **III-a**; **III-b**; **III-c**; **III-d**; **III-e**; **III-f**, **III-g**, **III-h**, **III-l**, **III-j**, **III-k** and **III-l**;

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wherein R^{23} , R^{23a} , R^{24} and R^{25} are as defined above, preferably the group of Formula (III) is selected from (III-a), (III-g) and (III-h);

R^6 and R^{6a} , are independently selected from hydrogen and optionally substituted C_{1-6} alkyl;

5 R^7 is selected from: hydrogen or C_{1-4} alkyl;

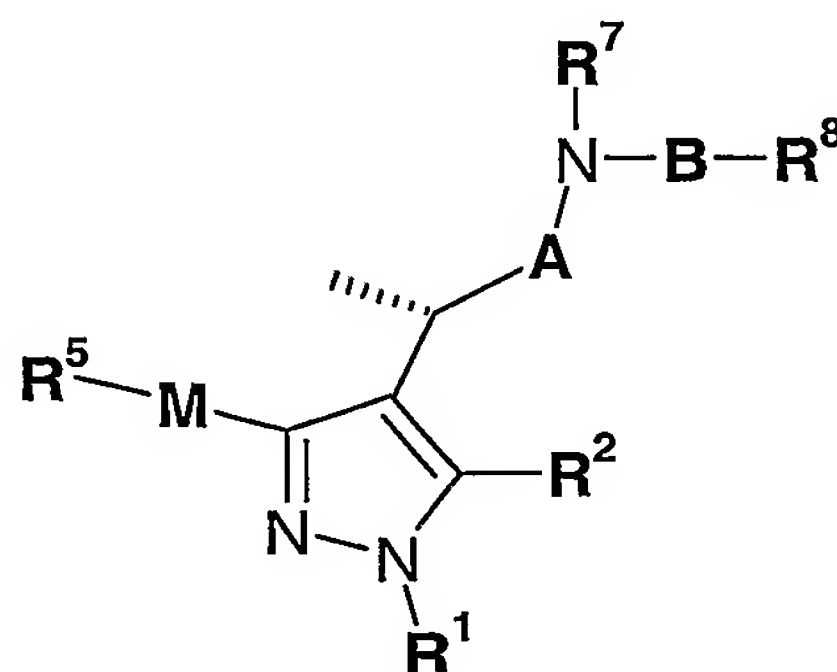
R^8 is selected from hydrogen, cyano, C_{1-6} alkyl, halo C_{1-6} alkyl, C_{2-6} alkynyl, C_{1-6} alkanoyl, C_{1-4} alkoxy C_{1-4} alkyl, C_{1-6} alkoxycarbonyl, N,N-di- C_{1-4} alkylamino, aryl, aryl C_{1-6} alkyl, C_{3-7} cycloalkyl, C_{3-7} cycloalkyl C_{1-6} alkyl, heterocyclyl, heterocyclyl C_{1-6} alkyl, or heterocyclylcarbonyl C_{1-4} alkyl wherein aryl and heterocyclyl rings are optionally

10 substituted by cyano and C_{1-4} alkyl; and

R^2 , and R^5 ; are as defined above

or salt, solvate or pro-drug thereof.

A further preferred group of compounds of the invention comprises a compound of Formula (Id):



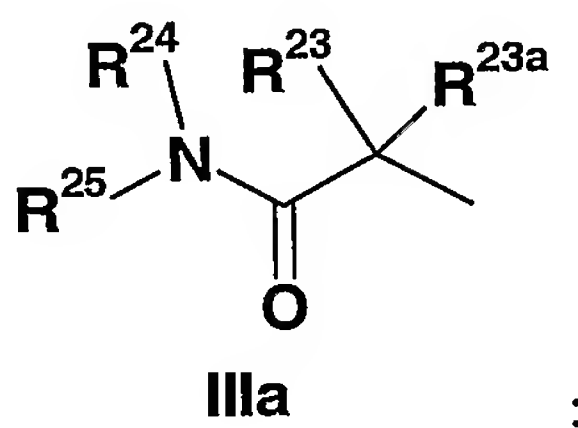
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Formula (Id)

Wherein R^1 , R^2 , R^5 ; R^7 , R^8 , A, B and M are as defined above or salt, solvate or pro-drug thereof.

A yet further preferred group of compounds of the invention comprises a compound of
5 Formula (Ib), (Ic) or (Id) wherein:

R^5 is a group of Formula (III) wherein the group of Formula (III) is a group of formula IIIa:



wherein R^{23} , R^{23a} , R^{24} and R^{25} are as defined above;

10 or a salt, pro-drug or solvate thereof.

According to a further aspect of the invention there is provided a compound of Formula (I) or Formula (Ia), or salt, solvate or pro-drug thereof, wherein R^3 is selected from a group of Formula (IIc) or Formula (IId) and R^1 , R^2 and R^5 are as defined above.

According to a further aspect of the invention there is provided a compound of Formula
15 (I) or Formula (Ia), or salt, solvate or pro-drug thereof, wherein R^3 is selected from a group of Formula (IIe) or Formula (IIf) and R^1 , R^2 and R^5 are as defined above.

According to a further aspect of the invention there is provided a compound of Formula (I) or Formula (Ia), or salt, solvate or pro-drug thereof, wherein R^3 is selected from a group of Formula (IIa), Formula (IIc) or Formula (IIe) and R^1 , R^2 and R^5 are as defined
20 above.

According to a further aspect of the invention there is provided a compound of Formula (I) or Formula (Ia), or salt, solvate or pro-drug thereof, wherein R^3 is selected from a group of Formula (IIb), Formula (IId) or Formula (IIf) and R^1 , R^2 and R^5 are as defined above.

25 Particularly preferred compounds according to the present invention are wherein the compound is selected from:

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- 2-[3-(2,2-dimethyl-3-oxo-3-{azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-(1,3-benzodioxol-5-yl)ethyl]-(2*S*)-propylamine;
- 2-[3-(2,2-dimethyl-3-oxo-3-{azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-pyrid-4-ylethyl]-(2*S*)-propylamine;
- 2-[3-(2,2-dimethyl-3-oxo-3-{azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-pyrid-4-ylbutyl]-(2*S*)-propylamine;
- 2-[3-(2,2-dimethyl-3-oxo-3-{azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[4-(4-methoxyphenyl)butyl]-(2*S*)-propylamine;
- 2-[3-(2,2-dimethyl-3-oxo-3-{azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-phenylethyl]-(2*S*)-propylamine;
- 2-[3-(2,2-dimethyl-3-oxo-3-{azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-(43-trifluoromethylphenyl)ethyl]-(2*S*)-propylamine;
- 2-[3-(2,2-dimethyl-3-oxo-3-{azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-(4-fluorophenyl)ethyl]-(2*S*)-propylamine;
- 2-[3-(2,2-dimethyl-3-oxo-3-{azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-(3-fluorophenyl)ethyl]-(2*S*)-propylamine;
- 2-[3-(2,2-dimethyl-3-oxo-3-{azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-(3-methoxyphenyl)ethyl]-(2*S*)-propylamine;
- 2-[3-(2,2-dimethyl-3-oxo-3-{azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-(4-methoxyphenyl)ethyl]-(2*S*)-propylamine;
- 2-[3-(2,2-dimethyl-3-oxo-3-{azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-(3,4-difluorophenyl)ethyl]-(2*S*)-propylamine;
- 2-[3-(2,2-dimethyl-3-oxo-3-{azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-(4-isopropylureidophenyl)ethyl]-(2*S*)-propylamine;
- 2-[3-(2,2-dimethyl-3-oxo-3-{azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-2-[3-(2,2-dimethyl-3-oxo-3-{azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-(4-{cyclopentylcarbonylamino}phenyl)ethyl]-(2*S*)-propylamine;
- [2-(4-methylsulphonylaminophenyl)ethyl]-(2*S*)-propylamine;

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- 2-[3-(2,2-dimethyl-3-oxo-3-{ azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-(4-{isopropoxycarbonylamino}phenyl)ethyl]-(2*S*)-propylamine;
- 2-[3-(2,2-dimethyl-3-oxo-3-{ azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-(4-{cyclohexylureido}phenyl)ethyl]-(2*S*)-propylamine;
- 2-[3-(2,2-dimethyl-3-oxo-3-{ azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-(1-methyl-2-oxo-1,2-dihydroquinolin-6-yl)ethyl]-(2*S*)-propylamine;
- 3-[2,2-dimethyl-3-oxo-3-(azabicyclo[2.2.2]oct-2-yl)propoxy]-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-(3-methoxyphenyl)ethyl]-(2*S*)-propylamine; and
- 2-[3-(2,2-dimethyl-3-oxo-3-{ azabicyclo[2.2.2]oct-2-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-(1,3-benzodioxol-5-yl)ethyl]-(2*S*)-propylamine;
- or a salt, pro-drug or solvate thereof.
- More particularly preferred compounds according to the present invention are wherein the compound is selected from:
- 2-[3-(2,2-dimethyl-3-oxo-3-{ azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-(1,3-benzodioxol-5-yl)ethyl]-(2*S*)-propylamine;
- 2-[3-(2,2-dimethyl-3-oxo-3-{ azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-pyrid-4-ylethyl]-(2*S*)-propylamine;
- 2-[3-(2,2-dimethyl-3-oxo-3-{ azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-pyrid-4-ylbutyl]-(2*S*)-propylamine;
- 2-[3-(2,2-dimethyl-3-oxo-3-{ azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[4-(4-methoxyphenyl)butyl]-(2*S*)-propylamine;
- 2-[3-(2,2-dimethyl-3-oxo-3-{ azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-(43-trifluoromethylphenyl)ethyl]-(2*S*)-propylamine;
- 2-[3-(2,2-dimethyl-3-oxo-3-{ azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-(4-fluorophenyl)ethyl]-(2*S*)-propylamine;
- 2-[3-(2,2-dimethyl-3-oxo-3-{ azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-(3-methoxyphenyl)ethyl]-(2*S*)-propylamine;

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2-[3-(2,2-dimethyl-3-oxo-3-{ azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-(4-methoxyphenyl)ethyl]-(2*S*)-propylamine;
 2-[3-(2,2-dimethyl-3-oxo-3-{ azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-
 5 [2-(4-methylsulphonylaminophenyl)ethyl]-(2*S*)-propylamine; and
 2-[3-(2,2-dimethyl-3-oxo-3-{ azabicyclo[2.2.2]oct-2-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-(1,3-benzodioxol-5-yl)ethyl]-(2*S*)-propylamine;
 or a salt, pro-drug or solvate thereof.

Most preferred compounds according to the present invention are wherein the
 10 compound is selected from:

2-[3-(2,2-dimethyl-3-oxo-3-{ azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-(1,3-benzodioxol-5-yl)ethyl]-(2*S*)-propylamine; and
 2-[3-(2,2-dimethyl-3-oxo-3-{ azabicyclo[2.2.2]oct-2-yl}propoxy)-5-(3,5-dimethylphenyl)-
 15 1*H*-pyrazol-4-yl]-*N*-[2-(1,3-benzodioxol-5-yl)ethyl]-(2*S*)-propylamine;
 or a salt, pro-drug or solvate thereof.

In another embodiment of the invention preferred compounds according to the present invention are wherein the compound is selected from:

2-[3-(2,2-dimethyl-3-oxo-3-pyrrolidin-1-ylpropoxy)-5-(3,5-dimethylphenyl)-1*H*-
 20 pyrazol-4-yl]-*N*-(2-pyridin-4-ylethyl)ethanamine;
 2-[3-(2,2-dimethyl-3-oxo-3-pyrrolidin-1-ylpropoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-(2-pyridin-4-ylbutyl)ethanamine;
 2-[3-(2,2-dimethyl-3-oxo-3-(7-azabicyclo[2.2.1]hept-7-yl)propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-(2-pyridin-4-ylethyl)ethanamine; and
 25 2-[3-(2,2-dimethyl-3-oxo-3-(7-azabicyclo[2.2.1]hept-7-yl)propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-(2-pyridin-4-ylbutyl)ethanamine;
 or a salt, pro-drug or solvate thereof.

The compounds of Formula (I) may be administered in the form of a pro-drug which is broken down in the human or animal body to give a compound of the Formula (I). Examples
 30 of pro-drugs include in-vivo hydrolysable esters of a compound of the Formula (I). Various forms of pro-drugs are known in the art. For examples of such pro-drug derivatives, see:

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- a) Design of Prodrugs, edited by H. Bundgaard, (Elsevier, 1985) and Methods in Enzymology, Vol. 42, p. 309-396, edited by K. Widder, et al. (Academic Press, 1985);
- b) A Textbook of Drug Design and Development, edited by Krogsgaard-Larsen and H. Bundgaard, Chapter 5 "Design and Application of Prodrugs", by H. Bundgaard p. 113-191 (1991);
- c) H. Bundgaard, Advanced Drug Delivery Reviews, 8, 1-38 (1992);
- d) H. Bundgaard, et al., Journal of Pharmaceutical Sciences, 77, 285 (1988); and
- e) N. Kakeya, et al., Chem Pharm Bull, 32, 692 (1984).
- 10 An in-vivo hydrolysable ester of a compound of the Formula (I) containing a carboxy or a hydroxy group is, for example, a pharmaceutically-acceptable ester which is hydrolysed in the human or animal body to produce the parent acid or alcohol. Suitable pharmaceutically-acceptable esters for carboxy include C₁₋₆alkoxymethyl esters for example methoxymethyl, C₁₋₆alkanoyloxymethyl esters for example pivaloyloxymethyl, phthalidyl
- 15 esters, C₃₋₈cycloalkoxycarbonyloxyC₁₋₆alkyl esters for example 1-cyclohexylcarbonyloxyethyl; 1,3-dioxolen-2-onylmethyl esters, for example 5-methyl-1,3-dioxolen-2-onylmethyl; and C₁₋₆alkoxycarbonyloxyethyl esters.

An in-vivo hydrolysable ester of a compound of the Formula (I) containing a hydroxy group includes inorganic esters such as phosphate esters (including phosphoramidic

20 cyclic esters) and α -acyloxyalkyl ethers and related compounds which as a result of the in-vivo hydrolysis of the ester breakdown to give the parent hydroxy group/s. Examples of α -acyloxyalkyl ethers include acetoxymethoxy and 2,2-dimethylpropionyloxy-methoxy. A selection of in-vivo hydrolysable ester forming groups for hydroxy include alkanoyl, benzoyl, phenylacetyl and substituted benzoyl and phenylacetyl, alkoxycarbonyl (to give

25 alkyl carbonate esters), dialkylcarbamoyl and N-(dialkylaminoethyl)-N-alkylcarbamoyl (to give carbamates), dialkylaminoacetyl and carboxyacetyl.

A suitable pharmaceutically-acceptable salt of a compound of the invention is, for example, an acid-addition salt of a compound of the invention which is sufficiently basic, for example, an acid-addition salt with, for example, an inorganic or organic acid, for example

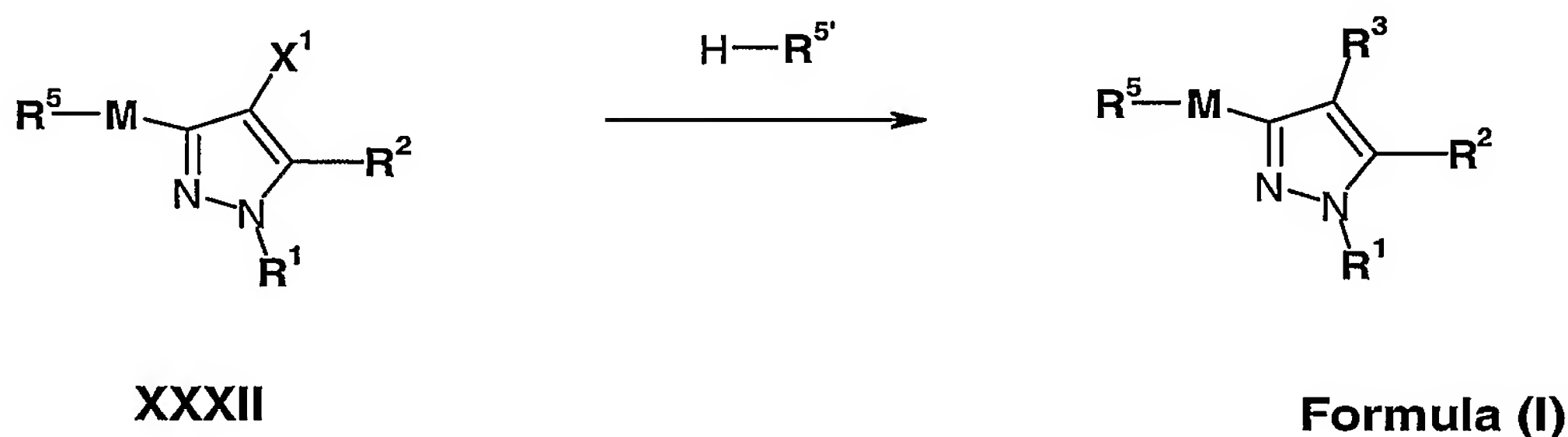
30 hydrochloric, hydrobromic, sulphuric, phosphoric, trifluoroacetic, citric or maleic acid. In addition a suitable pharmaceutically-acceptable salt of a compound of the invention which is sufficiently acidic is an alkali metal salt, for example a sodium or potassium salt, an alkaline earth metal salt, for example a calcium or magnesium salt, an ammonium salt or a salt with an

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organic base which affords a physiologically-acceptable cation, for example a salt with methylamine, dimethylamine, trimethylamine, piperidine, morpholine or tris-(2-hydroxyethyl)amine.

The compounds of Formula (I) can be prepared by a process comprising a step selected from (a) to (h) as follows, these processes are provided as a further feature of the invention:-

- (a) Reaction of a compound of formula **XXXII** with a compound of formula $L^2-R^{5'}$ to form a compound of Formula (I),



wherein X^1 is selected from:

and

 ; L^1 is a displaceable group; and

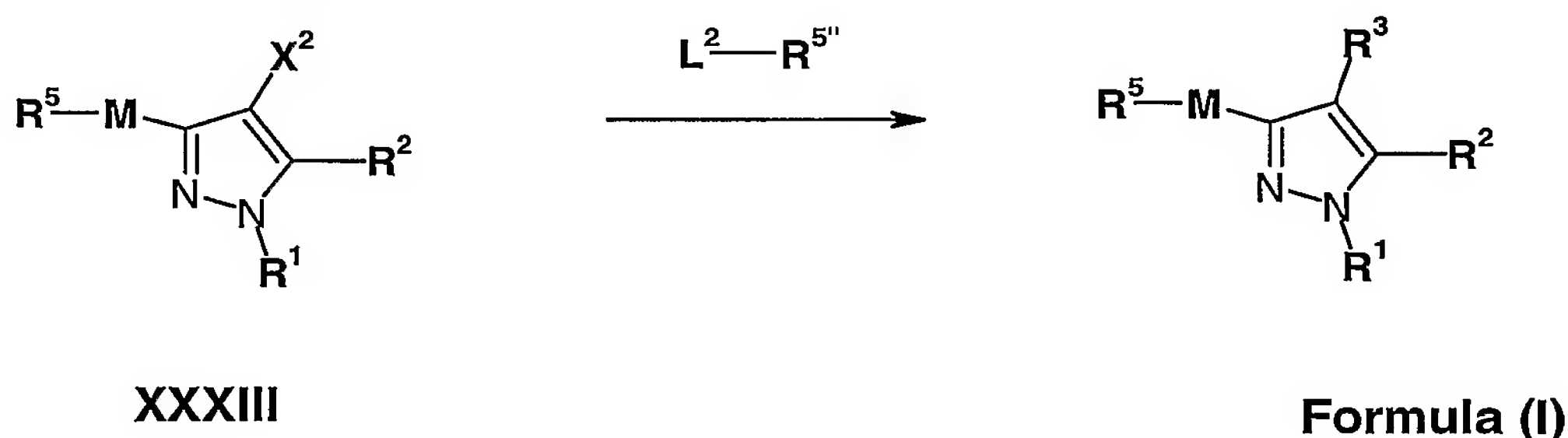
$H-R^{5'}$ is selected from:

,

 and

 ;

- (b) Reaction of a compound of formula **XXXIII** with a compound of formula $H-R^{5''}$ to form a compound of Formula (I),



wherein X^2 is selected from:

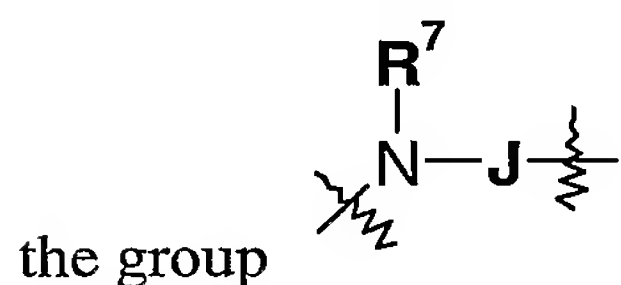
and

 ; L^2 is a displaceable group and R^{7a} is selected from the definition of R^7 or R^{22} above, and

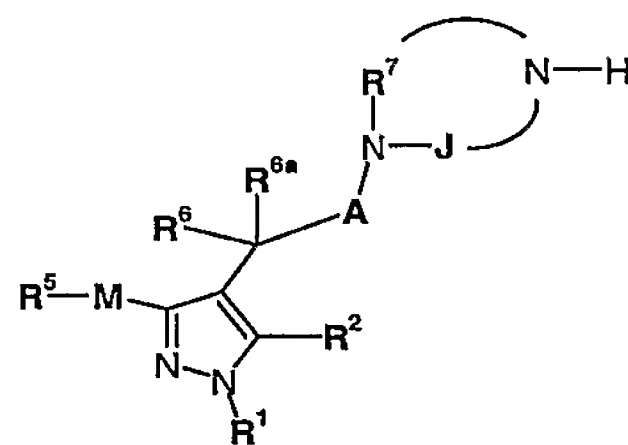
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$L^2-R^{5''}$ is selected from: L^2-B-R^8 , $L^2-J-K-R^8$ and L^2-R^{21}

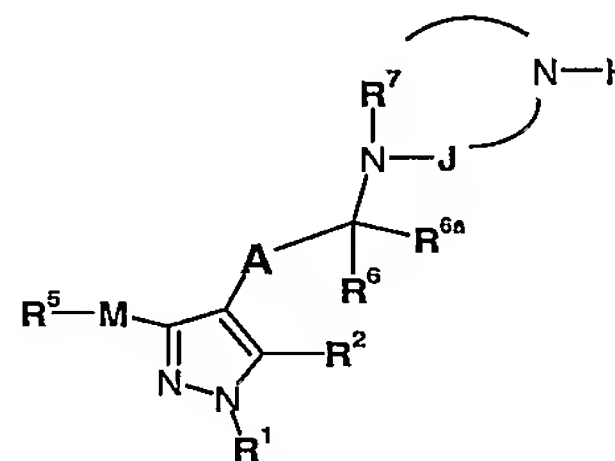
- (c) For compounds of Formula (I) wherein R^3 is a group of Formula (IIa), (IIb), (IIc) or (IId) and R^7 is other than part of a heterocyclic ring or hydrogen, reaction of a compound of Formula (I) wherein R^3 is a group of Formula (IIa), (IIb), (IIc) or (IId) and R^7 is hydrogen with a group of formula L^3-R^{7a} , wherein R^{7a} is as defined above for R^7 with the exclusion of hydrogen and L^3 is a displaceable group;
- (d) For compounds of Formula (I) wherein R^3 is a group of Formula (IIe) or (IIf) and R^{21} is other than hydrogen, reaction of a compound of Formula (I) wherein R^3 is a group of Formula (IIe) or (IIf) and R^{21} is hydrogen with a group of formula L^4-R^{21a} , wherein R^{21a} is as defined above for R^{21} with the exclusion of hydrogen and L^4 is a displaceable group;
- (e) For compounds of Formula (I) wherein R^3 is a group of Formula (IIe) or (IIf) and R^{22} is other than hydrogen, reaction of a compound of Formula (I) wherein R^3 is a group of Formula (IIe) or (IIf) and R^{22} is hydrogen with a group of formula L^5-R^{22a} , wherein R^{22a} is as defined above for R^{22} with the exclusion of hydrogen and L^5 is a displaceable group;
- (f) For compounds of Formula (I) wherein R^3 is a group of Formula (IIc) or (IId) and



- together forms an optionally substituted nitrogen-containing heterocyclic ring containing 4-7 carbons atoms, reaction of a compound of Formula XXXIVa or XXXIVb, with a compound of Formula L^6-K-R^8 , wherein L^6 is a displaceable group



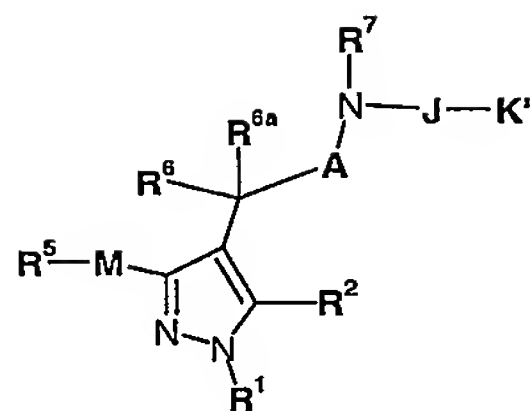
XXXIVa



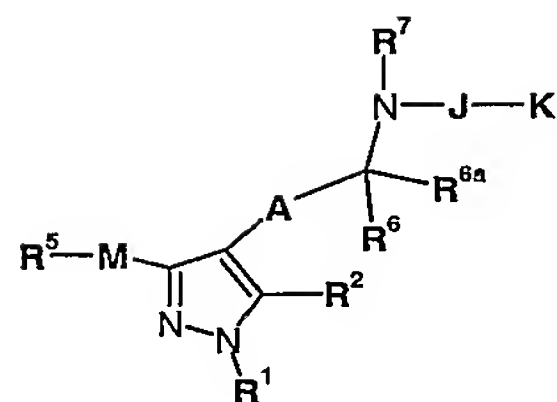
XXXIVb

- (g) For compounds of Formula (I) wherein R^3 is a group of Formula (IIc) or (IId), reaction of a compound of Formula XXXVa or XXXVb, with a compound of Formula $L^7-K''-R^8$, wherein L^7 is a displaceable group, and wherein the groups K' and K'' comprise groups which when reacted together form K ,

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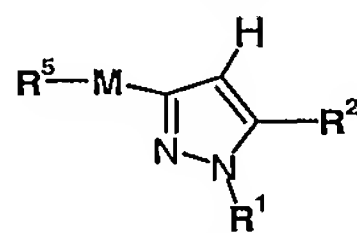
XXXVa



XXXVb

;

(h) reaction of a compound of Formula **XXXVI** with an electrophilic compound of the formula L^8-R^5 , wherein L^8 is a displaceable group



XXXVI

5 and thereafter if necessary:

- i) converting a compound of the Formula (I) into another compound of the Formula (I);
- ii) removing any protecting groups;
- iii) forming a salt, pro-drug or solvate.

Specific reaction conditions for the above reactions are as follows:

- 10 *Process a)* Compounds of formula **XXXII** and $H-R^{5'}$ can be coupled together in the presence of an organic base (such as DIPEA [di-isopropylethylamine]) or an inorganic base (such as potassium carbonate) base, in a suitable solvent such as DMA or DMF, at a temperature from room temperature and 120°C. Suitable displaceable groups include: a halide, such as chloro, or a methane sulphonate or toluene sulphonate;
- 15 *Process b)* Compounds of **XXXIII** and $L^2-R^{5''}$ can be coupled together in the presence of an organic base (such as DIPEA) or an inorganic base (such as potassium carbonate), in a suitable solvent such as DMA or DMF, at a temperature from room temperature to 120°C. Suitable displaceable groups include: a halide, such as chloro, or a methane sulphonate or toluene sulphonate,
- 20 alternatively if L^2 is a hydroxy group then the $L^2-R^{5''}$ can be reacted with a compound of formula **XXXIII** under Mitsunobu reaction conditions;
- Process c, d, e and f)* Reaction conditions to facilitate these reactions can be using
 - (i) alkylation reaction conditions or (ii) acylation reaction conditions: Examples of said conditions include:
- 25 (i) alkylation reaction conditions - the presence of an organic base (such as DIPEA) or an inorganic base (such as potassium carbonate), in a suitable solvent such as DMF, DMA,

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DCM, at a temperature from room temperature to 120°C. Suitable displaceable groups include: a halide, such as chloro, methane sulphonate or toluene sulphonate;

- (ii) acylation reaction conditions - presence of organic base, such as triethylamine, temperature 0°C to 50-60°C in a suitable solvent such as DCM. Suitable displaceable groups include an acylchloride or an acid anhydride,

Process g) The skilled man would be familiar with a variety of reaction conditions and values for K' and K'' , which when reacted together would form the group K , examples of said conditions and values for K' and K'' include:

- (i.) *For compounds of Formula (I) where K is $-(CH_2)_{s1}-N(R^9)C(O)-(CH_2)_{s2}-$*
 these can be prepared by reacting a compound where K' is $-(CH_2)_{s1}-N(R^9)H$ with a carboxylic acid for formula $HOOC-(CH_2)_{s2}-R^8$ to form the amide. Coupling of amino groups with carboxylic acids are well known in the art and can be facilitated by a number of chemical reactions using an appropriate coupling reagent. For example a carbodiimide coupling reaction can be performed with EDCI in the presence of DMAP in a suitable solvent such as DCM, chloroform or DMF at room temperature;
- (ii.) *For compounds of Formula (I) where K is $-(CH_2)_{s1}-C(O)N(R^9)-(CH_2)_{s2}-$*
 these can be prepared by reacting a compound where K' is $-(CH_2)_{s1}-COOH$ with an amine of the $HN(R^9)-(CH_2)_{s2}-R^8$ to form the amide. Methodology is identical to processes described in (i) above in this section;
- (iii.) *For compounds of Formula (I) where K is $-(CH_2)_{s1}-N(R^9)C(O)O-(CH_2)_{s2}-$*
 these can be prepared by reacting a compound where K' is $-(CH_2)_{s1}-N(R^9)H$ with a chloroformate of formula $ClC(O)O--(CH_2)_{s2}-R^8$ in a suitable solvent, such as DCM or chloroform, in the presence of a base, such as *N*-methylmorpholine, pyridine or triethylamine, at a temperature between -10°C and 0°C;
- (iv.) *For compounds of Formula (I) where K is $-(CH_2)_{s1}-OC(O)N(R^9)-(CH_2)_{s2}-$*
 these can be prepared by reacting a compound where K' is $-(CH_2)_{s1}-OC(O)Cl$ with a compound of formula $HN(R^9)-(CH_2)_{s2}-R^8$. Methodology is identical to processes described in (iii) above in this section;
- (v.) *For compounds of Formula (I) where K is $-(CH_2)_{s1}-N(R^9)S(O_2)-(CH_2)_{s2}-$*
 these can be prepared by reacting a compound where K' is $-(CH_2)_{s1}-N(R^9)H$ with a sulphonyl chloride of formula $ClS(O_2)-(CH_2)_{s2}-R^8$ in the presence of a base, such as

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triethylamine or pyridine, in a suitable solvent such as chloroform or DCM at a temperature between 0°C and room temperature;

(vi.) *For compounds of Formula (I) where K is $-(CH_2)_{s1}-S(O_2)N(R^9)-(CH_2)_{s2}-$*

5 these can be prepared by reacting a compound where K' is $-(CH_2)_{s1}-S(O_2)Cl$ with a compound of $HN(R^9)-(CH_2)_{s2}-R^8$. Methodology is identical to processes described in (v) above in this section

(vii.) *For compounds of Formula (I) where K is $-(CH_2)_{s1}-N(R^9)-(CH_2)_{s2}-$*

10 these can be prepared by reacting a compound where K' is $-(CH_2)_{s1}-L^{11}$ with a compound of formula $HN(R^9)-(CH_2)_{s2}-R^8$, wherein L^{11} is a displaceable group. This reaction can be performed in the presence of an organic base (such as DIPEA) or an inorganic base (such as potassium carbonate), in a suitable solvent such as DMA or DMF, at a temperature from room temperature to 120°C. Suitable displaceable groups include: a halide, such as chloro, or a methane sulphonate or toluene sulphonate. Compounds can also be prepared by reacting a compound wherein K' is
15 $-(CH_2)_{s1}-N(R^9)H$ with a compound of formula $L^{11}-(CH_2)_{s2}-R^8$, under identical conditions.

(viii.) *For compounds of Formula (I) where K is $-(CH_2)_{s1}-O-(CH_2)_{s2}-$*

20 these can be prepared by reacting a compound where K' is $-(CH_2)_{s1}-OH$ with a compound of formula $L^{12}-(CH_2)_{s2}-R^8$, wherein L^{12} is a displaceable group. This reaction can be performed in the presence of an organic base (such as potassium *t*-butoxide) or an inorganic base (such as sodium hydride), in a suitable solvent such as DMA or DMF, at a temperature from room temperature and 120°C. Suitable displaceable groups include: a halide, such as bromo, or a methane sulphonate or toluene sulphonate. Compounds can also be prepared by reacting a compound
25 wherein K' is $-(CH_2)_{s1}-L^{12}$ with a compound of formula $HO-(CH_2)_{s2}-R^8$, under identical conditions.

(ix.) *For compounds of Formula (I) where K is $-(CH_2)_{s1}-C(O)-(CH_2)_{s2}-$*

30 these can be prepared by reacting a compound where K' is $-(CH_2)_{s1}-C(O)-L^{13}$ with a Grignard reagent of formula $BrMg(CH_2)_{s2}-R^8$, wherein L^{13} is a displaceable group. This reaction can be performed in a non-polar solvent such as THF or diethylether at a temperature between room temperature and the boiling point of the solvent. Suitable displaceable groups include: a halide, such as bromo, or a methane sulphonate or toluene sulphonate. Compounds can also be prepared by reacting a

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compound wherein $\mathbf{K'}$ is $-(\text{CH}_2)_{s1}\text{-MgBr}$ with a compound of formula $\mathbf{L^{13}\text{-C(O)\text{-}(CH}_2)_{s2}\text{-R}^8}$, under identical conditions.

Process h) reaction of a compound of Formula XXXVI with a compound of the formula $\mathbf{L^8\text{-R}^5}$, can be performed under Friedel Craft conditions, for example in the presence of diethylaluminium chloride in a suitable solvent, such as DCM, in an inert atmosphere such as nitrogen, at a temperature between room temperature and the boiling point of the solvent or under Mannich conditions, for example, formaldehyde and a primary or secondary amine in acetic acid, in an inert atmosphere such as nitrogen at a temperature between room temperature and 100°C. It will be appreciated by those skilled in the art that in the processes of the present invention certain functional groups such as hydroxyl or amino groups in the starting reagents or intermediate compounds may need to be protected by protecting groups. Thus, the preparation of the compounds of Formula (I) may involve, at an appropriate stage, the addition and subsequent removal of one or more protecting groups.

The protection and de-protection of functional groups is described in 'Protective Groups in Organic Chemistry', edited by J.W.F. McOmie, Plenum Press (1973) and 'Protective Groups in Organic Synthesis', 2nd edition, T.W. Greene and P.G.M. Wuts, Wiley-Interscience (1991).

A suitable protecting group for an amino or alkylamino group is, for example, an acyl group, for example an alkanoyl group such as acetyl, an alkoxycarbonyl group, for example a methoxycarbonyl, ethoxycarbonyl or *tert*-butoxycarbonyl group, an arylmethoxycarbonyl group, for example benzyloxycarbonyl, or an aroyl group, for example benzoyl. The de-protection conditions for the above protecting groups necessarily vary with the choice of protecting group. Thus, for example, an acyl group such as an alkanoyl or alkoxycarbonyl group or an aroyl group may be removed for example, by hydrolysis with a suitable base such as an alkali metal hydroxide, for example lithium or sodium hydroxide. Alternatively an acyl group such as a *tert*-butoxycarbonyl group may be removed, for example, by treatment with a suitable acid as hydrochloric, sulphuric or phosphoric acid or trifluoroacetic acid and an arylmethoxycarbonyl group such as a benzyloxycarbonyl group may be removed, for example, by hydrogenation over a catalyst such as palladium-on-carbon, or by treatment with a Lewis acid for example boron tris(trifluoroacetate). A suitable alternative protecting group for a primary amino group is, for example, a phthaloyl group which may be removed by treatment with an alkylamine, for example dimethylaminopropylamine, or with hydrazine.

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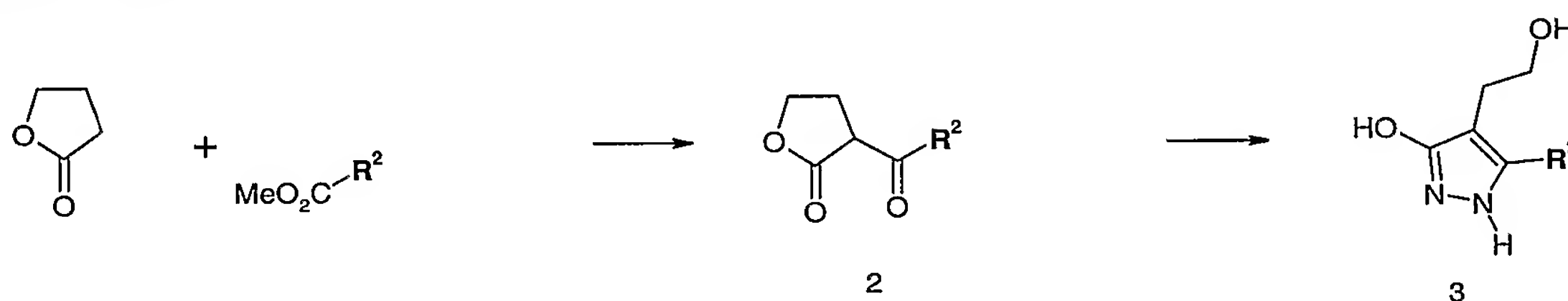
A suitable protecting group for a hydroxy group is, for example, an acyl group, for example an alkanoyl group such as acetyl, an aroyl group, for example benzoyl, or an arylmethyl group, for example benzyl. The de-protection conditions for the above protecting groups will necessarily vary with the choice of protecting group. Thus, for example, an acyl group such as an alkanoyl or an aroyl group may be removed, for example, by hydrolysis with a suitable base such as an alkali metal hydroxide, for example lithium or sodium hydroxide. Alternatively an arylmethyl group such as a benzyl group may be removed, for example, by hydrogenation over a catalyst such as palladium-on-carbon.

A suitable protecting group for a carboxy group is, for example, an esterifying group, for example a methyl or an ethyl group which may be removed, for example, by hydrolysis with a base such as sodium hydroxide, or for example a *tert*-butyl group which may be removed, for example, by treatment with an acid, for example an organic acid such as trifluoroacetic acid, or for example a benzyl group which may be removed, for example, by hydrogenation over a catalyst such as palladium-on-carbon.

15

EXPERIMENTAL

GENERAL REACTION SCHEMES



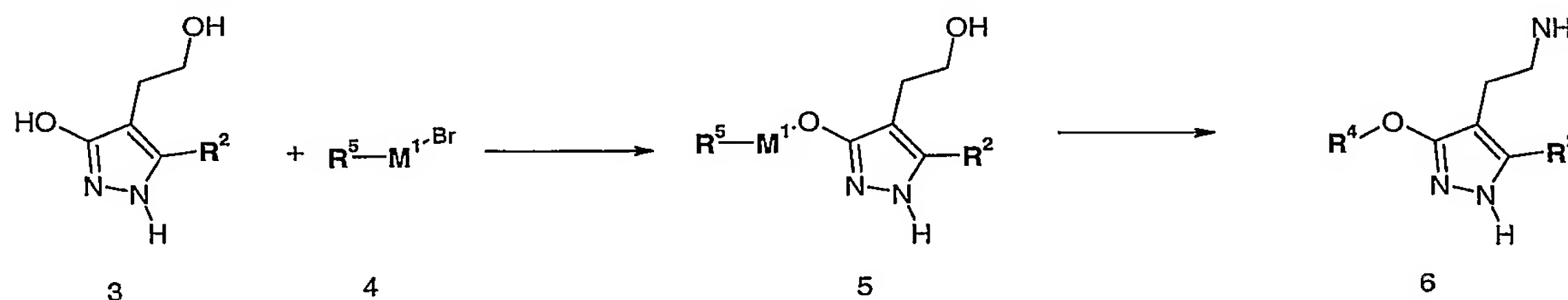
Scheme a

20 Pyrazoles, such as 3 can be synthesised in two steps (Scheme a):

(1) by the reaction of a lactone with the appropriate ester using a Claisen condensation to form a compound of formula 2, under conditions of an inert atmosphere, such as argon, at a temperature of about 0°C in a suitable solvent such as THF.

(2) followed by cyclization of a compound of formula 2 with hydrazine to form the pyrazole

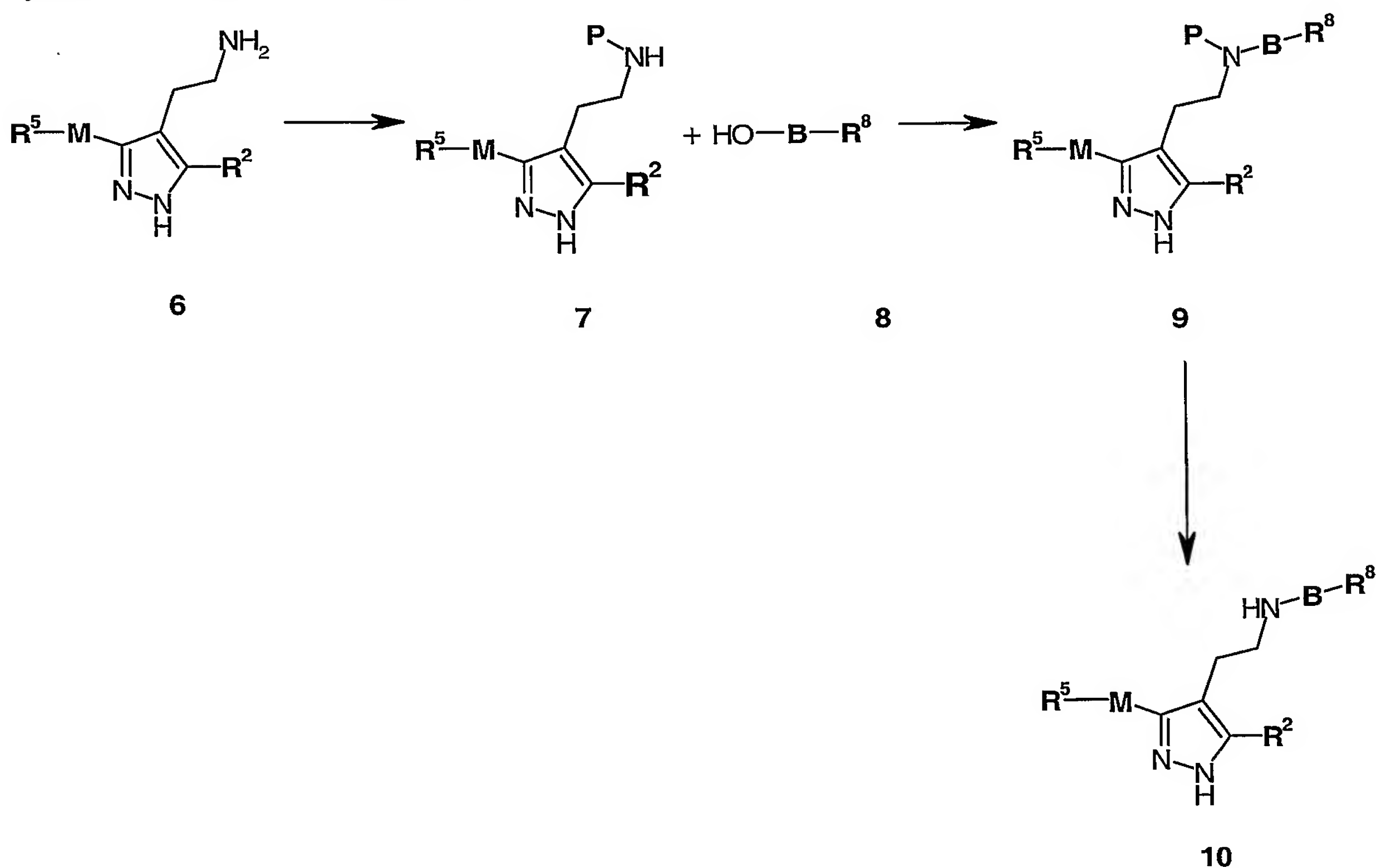
25 3, at a room temperature in a suitable solvent such as ethanol.



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Scheme b

The pyrazole **3** can undergo a selective alkylation reaction with a compound of formula **4**, under conditions of an inert atmosphere, such as argon, in the presence of a suitable base, such as potassium carbonate in the a suitable solvent such as DMA at a temperature of about 90°C, to form a compound of formula **5**. Then the amine **6** can be prepared from a compound of formula **5** and phthalimide using a Mitsunobu reaction with an activating agent such as diethyldiazocarboxylate (DEAD), diisopropyldiazocarboxylate or the like with triphenylphosphine, tri-butylphosphine and the like, in an inert solvent such as benzene, toluene, tetrahydrofuran or mixtures thereof, followed by deprotection with hydrazine to give the (Scheme b).



Scheme c.

A suitable pyrazole **6** can be converted to a compound of formula **10** by incorporation of a suitable protecting group (**P**) to form a compound of formula **7**, followed by a Mitsunobu reaction with a suitable alcohol **8** to form a compound of formula **9**, followed by deprotection.

EXAMPLES

The invention will now be illustrated with the following non-limiting Examples in which, unless otherwise stated:

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(i) evaporations were carried out by rotary evaporation in vacuo and work-up procedures were carried out after removal of residual solids such as drying agents by filtration;

(ii) operations were carried out at room temperature, that is in the range 18-25°C
5 and under an atmosphere of an inert gas such as argon or nitrogen;

(iii) yields are given for illustration only and are not necessarily the maximum attainable;

(iv) the structures of the end-products of the Formula (I) were confirmed by nuclear (generally proton) magnetic resonance (NMR) and mass spectral techniques; proton magnetic
10 resonance chemical shift values were measured on the delta scale and peak multiplicities are shown as follows: s, singlet; d, doublet; t, triplet; m, multiplet; br, broad; q, quartet, quin, quintet;

(v) intermediates were not generally fully characterised and purity was assessed by thin layer chromatography (TLC), high-performance liquid chromatography (HPLC),
15 infra-red (IR) or NMR analysis;

(vi) chromatography was performed on silica (Merck Keiselgel: Art.9385);

(vii) isolateTM refers to silica (SiO₂) based columns with irregular particles with an average size of 50µm with nominal 60 Å porosity [Source: Jones Chromatography, Ltd., Glamorgan, Wales, United Kingdom].

20

Abbreviations

boc	<i>t</i> -butoxycarbonyl
DCC	1,3-dicyclohexylcarbodiimide
DEAD	diethylazodicarboxylate
25 DMA	dimethylacetamide
DMAP	4-dimethylaminopyridine
DMSO	dimethyl sulphoxide
DMF	dimethylformamide
DNS	2,4-dinitrobenzenesulphonyl
30 EDC	1-(3-dimethylaminopropyl)-3-ethylcarbodiimide hydrochloride
HOBt	1-hydroxybenzotriazole
LHMDS	lithium bis(trimethylsilyl)amide

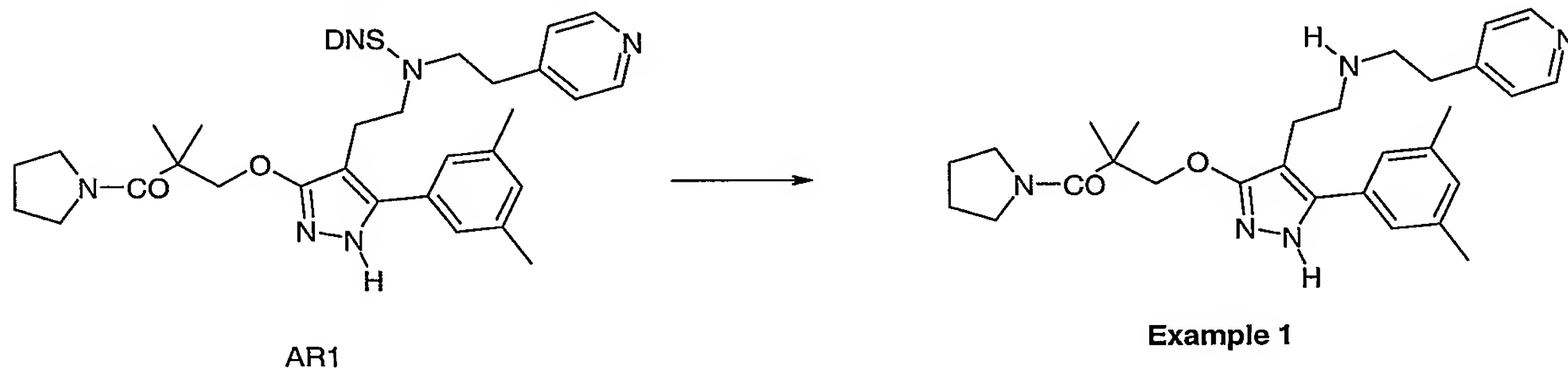
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THF

tetrahydrofuran

Example 1

2-[3-(2,2-dimethyl-3-oxo-3-pyrrolidin-1-ylpropoxy)-5-(3,5-dimethylphenyl)-1H-pyrazol-
5 4-yl]-N-(2-pyridin-4-ylethyl)ethanamine



A solution of **AR1** (123 mg ; 0.17 mmol) in CH₂Cl₂ (3 ml) was treated dropwise with propylamine (140 ul ; 1.7 mmol). The mixture was stirred at room temperature for 1h and
10 then purified directly by flash chromatography eluting with increasingly polar mixtures of EtOAc/CH₂Cl₂ (50 to 100% EtOAc) and then MeOH/CH₂Cl₂ (0 to 10% MeOH) to give **Example 1** as a beige solid (83 mg).

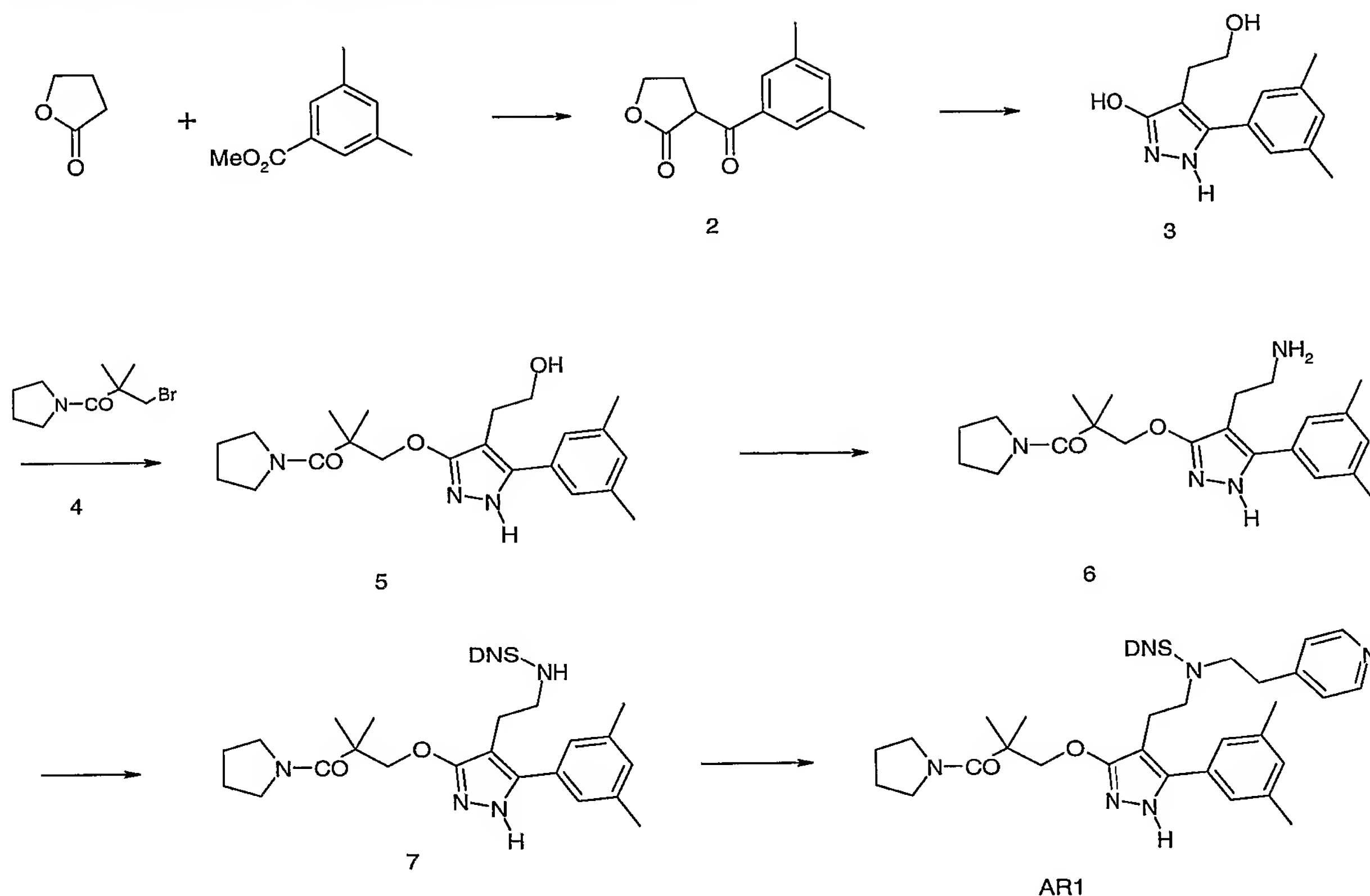
Yield : 100%

¹H NMR spectrum (DMSO d₆) : 1.27 (s, 6H) ; 1.75 (m, 4H) ; 2.3 (s, 6H) ; 2.55-2.95 (m, 8H) ;
15 3.5 (m, 4H) ; 4.18 (s, 2H) ; 7.03 (s, 1H) ; 7.10 (s, 2H) ; 7.2 (d, 2H) ; 8.44 (d, 2H), 11.9 (s br, 1H).

MS-ESI : 490 [M+H]⁺

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The starting material **AR1** was prepared as follows:-



A solution of methyl 3,5-dimethylbenzoate (25 g ; 152 mmol) and butyrolactone (40 ml ; 520 mmol) in THF (300 ml) under argon was cooled to 0°C and treated dropwise with LHMDS (200 ml ; 200 mmol ; 1M in hexanes). The mixture was stirred and allowed to warm to room temperature overnight. The THF was evaporated. The residue was taken up in Et₂O and the organic phase was washed with sat. aq. NaHCO₃, brine and dried over MgSO₄. The residue was purified by flash chromatography eluting with increasingly polar mixtures of EtOAc/hexanes (20 to 40% EtOAc) to give an oil which slowly crystallised to give **2** as a white solid (9.2 g). During the chromatography, the starting material methyl 3,5-dimethylbenzoate (12.4g) was recovered.

Yield : 55% based on recovered methyl 3,5-dimethylbenzoate.

¹H NMR spectrum (CDCl₃) : 2.39 (s, 6H) ; 2.5 (m, 1H) ; 2.82 (m, 1H) ; 4.41 (m, 1H) ; 4.51 (m, 2H) ; 7.25 (s, 1H) ; 7.65 (s, 2H).

MS-ESI : 219 [M+H]⁺

Compound **2** (7.43 g ; 34 mmol) was dissolved in EtOH (200 ml) and hydrazine hydrate (17.2 ml ; 354 mmol) was added. The mixture was stirred for 30 min. The solvent was evaporated and the residue was triturated with pentane to give **3** as a white solid (7.05 g).

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Yield : 90%

^1H NMR spectrum (DMSO d_6) : 2.32 (s, 6H) ; 2.58 (t, 2H) ; 3.50 (t, 2H) ; 4.8 (br s, 1H) ; 7.01 (s, 1H) ; 7.14 (s, 2H) ; 9.5 (br s, 1H).

MS-ESI : 233 $[\text{M}+\text{H}]^+$

5

A mixture of **3** (4.26 g ; 18.4 mmol) and **4** (4.51 g ; 19.3 mmol) in DMA (40 ml) under argon was treated with K_2CO_3 (5.07 g ; 36.7 mmol). The mixture was stirred and heated at 90°C for 2h. The mixture was poured into sat. aq. NaHCO_3 , extracted with EtOAc and the organic phase was washed with water, brine and dried over MgSO_4 . The residue was purified by flash chromatography eluting with increasingly polar mixtures of EtOAc/ CH_2Cl_2 (0 to 100% EtOAc) to give the alcohol **5** as a pale yellow oil (6.56 g).

Yield : 93%

^1H NMR spectrum (DMSO d_6) : 1.30 (s, 6H) ; 1.8 (m, 4H) ; 2.33 (s, 6H) ; 2.55 (m, 2H) ; 3.32 (m, 2H) ; 3.5 (m, 4H) ; 4.17 (s, 2H) ; 4.62 (t, 1H) ; 7.04 (s, 1H) ; 7.16 (s, 2H) ; 11.9 (br s, 1H).

15 MS-ESI : 386 $[\text{M}+\text{H}]^+$

A mixture of **5** (3.85 g ; 10 mmol), phthalimide (1.62 g ; 11 mmol) and triphenylphosphine (10.5 g ; 40 mmol) in THF (100 ml) at 0°C under argon was treated with DEAD (6.33 ml ; 40 mmol). The mixture was stirred at this temperature for 1h when water was added. The mixture was extracted with Et_2O and the organic phase was washed with water, brine and dried over MgSO_4 .

Evaporation gave a crude solid which, without further purification, was immediately taken up in EtOH (50 ml) and treated with hydrazine hydrate (5 ml ; 100 mmol). The mixture was stirred for 1.5h and then the EtOH was partially evaporated. Addition of CH_2Cl_2 caused precipitation of phthalhydrazide which was filtered and rinsed with CH_2Cl_2 . The filtrate was evaporated and the residue was purified by flash chromatography eluting with increasingly polar mixtures of EtOAc/ CH_2Cl_2 (0 to 100% EtOAc) and then MeOH/ CH_2Cl_2 (0 to 8% MeOH) to give **6** as a beige solid (2.34 g).

Yield : 61%

30 ^1H NMR spectrum (DMSO d_6) : 1.30 (s, 6H) ; 1.79 (m, 4H) ; 2.33 (s, 6H) ; 2.52 (m, 2H) ; 2.67 (t, 2H) ; 3.5 (m, 4H) ; 4.18 (s, 2H) ; 7.03 (s, 1H) ; 7.14 (s, 2H) ; 8.95 (br s, 1H).

MS-ESI : 385 $[\text{M}+\text{H}]^+$

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A solution of **6** (200 mg ; 0.52 mmol) in CH₂Cl₂ (5 ml) was treated with diisopropylethylamine (135 ul ; 0.78 mmol) and cooled to 0°C. A solution of 2,4-dinitrobenzenesulphonyl chloride (153 mg ; 0.57 mmol) in CH₂Cl₂ (1 ml) was added dropwise and the mixture was allowed to warm to room temperature for 30 min. The mixture was
 5 purified directly by flash chromatography eluting with increasingly polar mixtures of EtOAc/CH₂Cl₂ (0 to 50% EtOAc) to give **7** as a cream solid (224 mg).

Yield : 70%

¹H NMR spectrum (DMSO d₆) : 1.24 (s, 6H) ; 1.75 (m, 4H) ; 2.29 (s, 6H) ; 2.57 (m, 2H) ; 3.11 (m, 2H) ; 3.5 (m, 4H) ; 4.15 (s, 2H) ; 7.0 (s, 1H) ; 7.03 (s, 2H) ; 8.14 (d, 1H) ; 8.56 (q,
 10 1H) ; 8.6 (br s, 1H) ; 8.83 (d, 1H).

MS-ESI : 615 [M+H]⁺

A mixture of **7** (170 mg ; 0.27 mmol), 4-(2-hydroxyethyl)-pyridine (38 mg ; 0.3 mmol) and triphenylphosphine (283 mg ; 1.08 mmol) in THF (10 ml) at 0°C under argon was treated
 15 with DEAD (170 ul ; 1.08 mmol). The mixture was allowed to warm to room temperature for 30 min. when water was added. The mixture was extracted with EtOAc and the organic phase was washed with water, brine and dried over MgSO₄. The residue was purified by flash chromatography eluting with increasingly polar mixtures of EtOAc/CH₂Cl₂ (0 to 100% EtOAc) **AR1** as a white solid (123 mg).

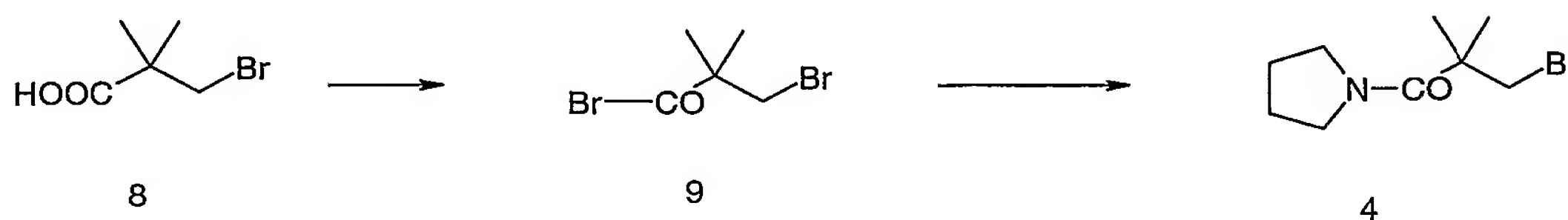
20

Yield : 63%

¹H NMR spectrum (DMSO d₆) : 1.27 (s, 6H) ; 1.7 (m, 4H) ; 2.28 (s, 6H) ; 2.69 (t, 2H) ; 2.83 (t, 2H) ; 3.4 (m, 4H) ; 3.48 (t, 2H) ; 3.56 (t, 2H) ; 4.21 (s, 2H) ; 7.01 (s, 1H) ; 7.08 (s, 2H) ; 7.19 (d, 2H) ; 8.15 (d, 1H) ; 8.41 (d, 2H) ; 8.42 (q, 1H) ; 8.89 (d, 1H).

25 MS-ESI : 720 [M+H]⁺

Starting material **4** was prepared as follows:-



A mixture of **8** (14.48 g ; 80 mmol) and oxalyl bromide (43.2 g ; 200 mmol) containing one
 30 drop of DMF was heated at 50°C for 2h and then cooled. The excess of oxalyl bromide was evaporated and the residue azeotroped with toluene to give crude **9** which was taken up

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directly in CH₂Cl₂ (25 ml) and cooled to 0°C. Diisopropylethylamine (14 ml ; 80 mmol) was added followed by a solution of pyrrolidine (3.3 ml ; 40 mmol) in CH₂Cl₂ (30 ml). The mixture was allowed to warm to room temperature overnight and was diluted with CH₂Cl₂, washed with aq. HCl (2N), aq. NaOH (1N), water, brine and dried over MgSO₄. The residue
 5 was purified by flash chromatography eluting with increasingly polar mixtures of EtOAc/CH₂Cl₂ (5 to 10% EtOAc) to give **4** as a white solid (6.5 g).

Yield : 70%

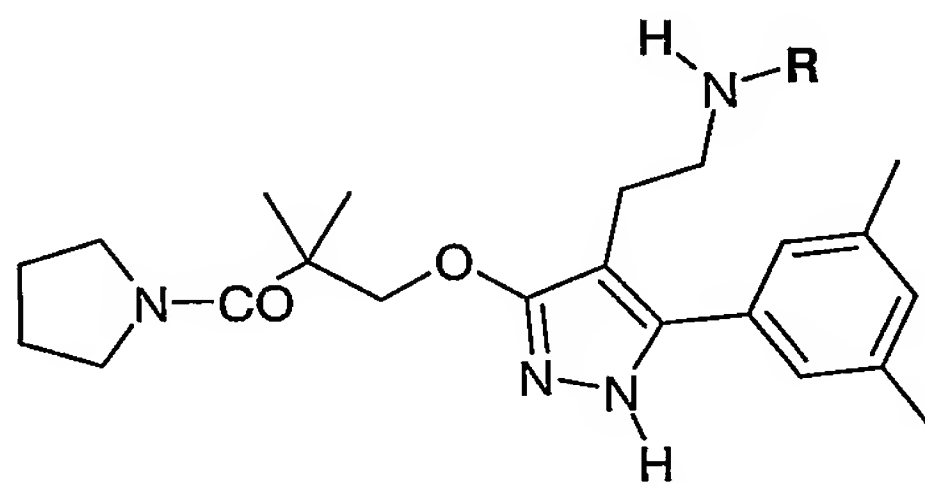
¹H NMR spectrum (DMSO d₆) : 1.39 (s, 6H) ; 1.9 (m, 4H) ; 3.57 (m, 4H) ; 3.62 (s, 2H)

MS-ESI : 235 [M+H]⁺

10

Examples 1.1-1.5

The following examples were prepared in a similar manner to Example 1,



the table shows the **R** group relating to the above structure, the reaction conditions and
 15 characteristics for each example, corresponding to the description of the preparation of Example 1 given above:-

Example 1.1

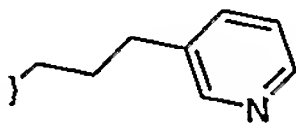
R	AR2 mg ; mmol	CH ₂ Cl ₂ ml	Propylamine μl ; mmol	Prod. Form	Mass mg ; Yield	MS- ESI
	210 ; 0.28	5	235 ; 2.86	White solid	111 ; 77%	504 [M+H]] ⁺

Chromato. – EtOAc and then MeOH/CH₂Cl₂ (0 to 10% MeOH)

20 ¹H NMR spectrum (DMSO d₆) : 1.27 (s, 6H) ; 1.75 (m, 4H) ; 2.31 (s, 6H) ; 2.57-2.63 (m, 6H) ; 2.75 (m, 2H) ; 3.3-3.7 (m, 4H) ; 4.18 (s, 2H) ; 7.03 (s, 1H) ; 7.11 (s, 2H) ; 7.2 (d, 2H) ; 8.44 (d, 2H); 11.9 (s br, 1H).

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Example 1.2

R	AR3 mg ; mmol	CH ₂ Cl ₂ ml	Propylamine μ l ; mmol	Prod. Form	Mass mg; Yield	MS- ESI
	120 ; 0.16	3	135 ; 1.63	White solid	60 ; 73%	504 [M+H]] ⁺

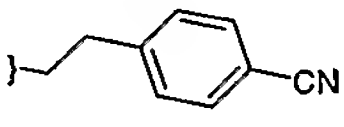
Chromato. – Ammonia in MeOH(7N)/CH₂Cl₂ (0 to 10% ammonia in MeOH)

¹H NMR spectrum (DMSO d₆) : 1.27 (s, 6H) ; 1.6-1.9 (m, 6H) ; 2.3 (s, 6H) ; 2.55-2.64 (m, 6H) ; 2.7 (m, 2H) ; 3.3-3.6 (m, 4H) ; 4.17 (s, 2H) ; 7.02 (s, 1H) ; 7.12 (s, 2H) ; 7.29 (dd, 1H) ;
5 7.58 (d, 1H) ; 8.39 (d, 1H) ; 11.9 (s br, 1H).

Examples 1.3 – 1.5 were prepared by a robot. The last two steps were carried out sequentially without isolation of the intermediates AR4, AR5 or AR6.

10

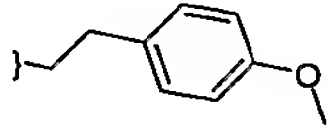
Example 1.3

R	AR4 mg ; mmol	CH ₂ Cl ₂ ml	Ammonia in MeOH(7N) ml	Prod. Form	Mass m g; Yield	MS- ESI
	nd* ; 0.23	5	0.5	oil	18 ; 15%	514 [M+H]] ⁺

Chromato. – LC/MS H₂O/MeCN buffered with ammonium carbonate at pH 8.9 (0 to 100% H₂O)

¹H NMR spectrum (DMSO d₆) : 1.26 (s, 6H) ; 1.74 (m, 4H) ; 2.3 (s, 6H) ; 2.55-2.8 (m, 8H) ;
15 3.4 (m, 4H) ; 4.16 (s, 2H) ; 7.02 (s, 1H) ; 7.10 (s, 2H) ; 7.36 (d, 2H) ; 7.71 (d, 2H) ; 11.9 (s br, 1H).

Example 1.4

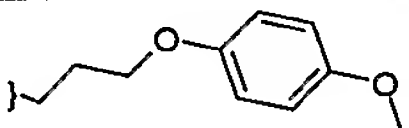
R	AR5 mg ; mmol	CH ₂ Cl ₂ ml	Ammonia in MeOH(7N) ml	Prod. Form	Mass m g; Yield	MS- ESI
	nd* ; 0.23	5	0.5	oil	15 ; 12%	519 [M+H]] ⁺

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Chromato. – LC/MS H₂O/MeCN buffered with ammonium carbonate at pH 8.9 (0 to 100% H₂O)

¹H NMR spectrum (DMSO d₆) : 1.27 (s, 6H) ; 1.74 (m, 4H) ; 2.30 (s, 6H) ; 2.5-2.75 (m, 8H) ; 3.5 (m, 4H) ; 3.71 (s, 3H) ; 4.16 (s, 2H) ; 6.81 (d, 2H) ; 7.02 (s, 1H) ; 7.05 (d, 2H) ; 7.11 (s, 2H) ; 11.9 (s br, 1H).

Example 1.5

R	AR6 mg ; mmol	CH ₂ Cl ₂ ml	Ammonia in MeOH(7N) ml	Prod. Form	Mass m g; Yield	MS- ESI
	nd* ; 0.23	5	0.5	oil	23 ; 18%	549 [M+H]] ⁺

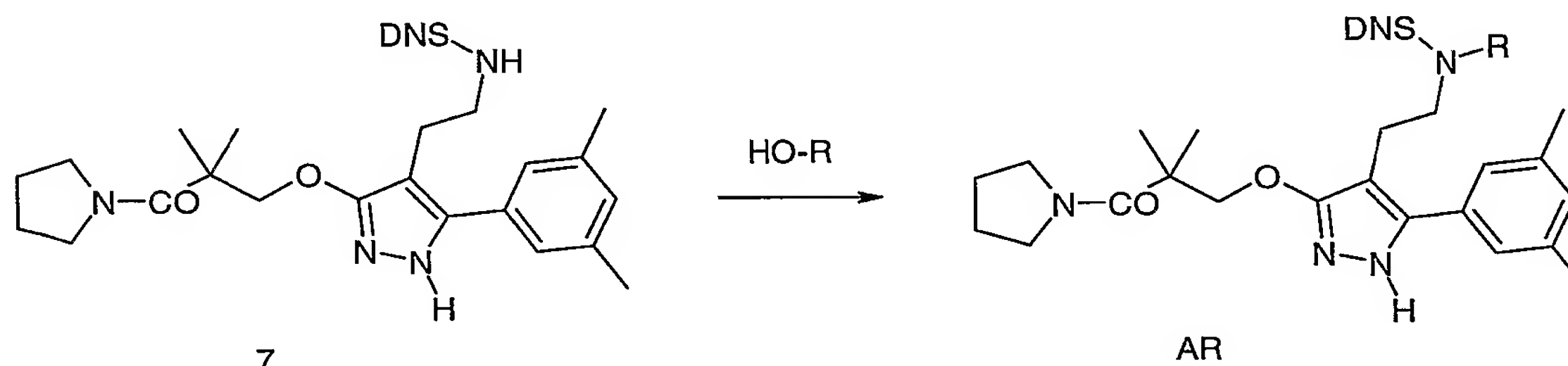
*nd = not determined

Chromato. – LC/MS H₂O/MeCN buffered with ammonium carbonate at pH 8.9 (0 to 100% H₂O)

¹H NMR spectrum (DMSO d₆) : 1.27 (s, 6H) ; 1.77 (m, 4H) ; 2.3 (s, 6H) ; 2.55-2.7 (m, 8H) ; 3.5 (m, 4H) ; 3.68 (s, 3H) ; 3.9 (t, 2H) ; 4.16 (s, 2H) ; 6.81 (m, 4H) ; 7.01 (s, 1H) ; 7.12 (s, 2H) ; 11.9 (s br, 1H).

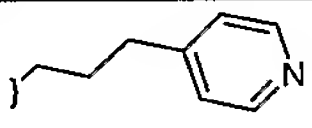
15 **Intermediates for Examples 1-1 - 1.5, AR2 – AR6 respectively**

Starting materials **AR2-AR6** were prepared as follows, the table showing the reaction conditions and characteristics for each example, corresponding to the description of **AR1** given above:-



- 60 -

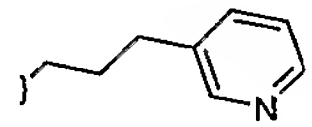
AR2

R	<u>7</u> mg ; mmol	Alcohol mg ; mmol	PPh3 mg ; mmol	THF ml	DEAD μ l ; mmol	Prod. Form	Mass mg ; Yield %	MS- ESI
	200 ; 0.32	55 ; 0.4	340 ; 1.3	10	205 ; 1.3	Yellow solid	216 ; 90%	734 [M+H]] ⁺

Chromato. - EtOAc/CH₂Cl₂ (0 to 100% EtOAc)

¹H NMR spectrum (DMSO d₆) : 1.22 (s, 6H) ; 1.6-1.8 (m, 4H) ; 1.84 (m, 2H) ; 2.28 (s, 6H) ; 2.55 (m, 2H) ; 2.69 (m, 2H) ; 3.3-3.5 (m, 8H) ; 4.18 (s, 2H) ; 7.00 (s, 1H) ; 7.07 (s, 2H) ; 7.19 (d, 2H) ; 8.17 (d, 1H) ; 8.43 (d, 2H) ; 8.47 (dd, 1H) ; 8.92 (d, 1H) ; 11.9 (s br, 1H).

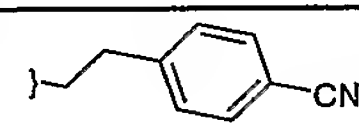
AR3

R	<u>7</u> mg ; mmol	Alcohol mg ; mmol	PPh3 mg ; mmol	THF ml	DEAD μ l ; mmol	Prod. Form	Mass mg ; Yield %	MS- ESI
	200 ; 0.32	55 ; 0.4	340 ; 1.3	5	205 ; 1.3	Yellow solid	122 ; 51%	734 [M+H]] ⁺

Chromato. - EtOAc/CH₂Cl₂ (0 to 100% EtOAc)

¹H NMR spectrum (DMSO d₆) : 1.22 (s, 6H) ; 1.5-1.9 (m, 4H) ; 1.84 (m, 2H) ; 2.28 (s, 6H) ; 2.55 (m, 2H) ; 2.68 (m, 2H) ; 3.3-3.5 (m, 8H) ; 4.18 (s, 2H) ; 7.00 (s, 1H) ; 7.07 (s, 2H) ; 7.28 (dd, 1H) ; 7.58 (d, 1H) ; 8.17 (d, 1H) ; 8.40 (m, 2H) ; 8.47 (dd, 1H) ; 8.92 (d, 1H) ; 11.9 (s br, 1H).

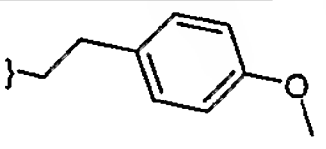
AR4

R	<u>7</u> mg ; mmol	Alcohol mg ; mmol	PPh3 mg ; mmol	THF ml	DTAD mg ; mmol	Prod. Form	Mass mg ; Yield %	MS- ESI
	145 ; 0.23	38 ; 0.26	360 ; 1.38	1	205 ; 0.9	nd*	nd*	nd*

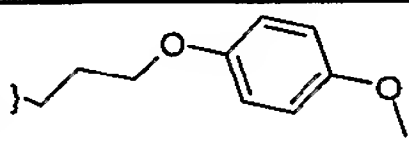
*not determined: Intermediate used directly in last step of robot run without isolation or purification.

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AR5

R	<u>7</u> mg ; mmol	Alcohol mg ; mmol	PPh ₃ mg ; mmol	THF ml	DTAD mg ; mmol	Prod. Form	Mass mg ; Yield %	MS- ESI
	145 ; 0.23	40 ; 0.26	360 ; 1.38	1	205 ; 0.9	nd*	nd*	nd*

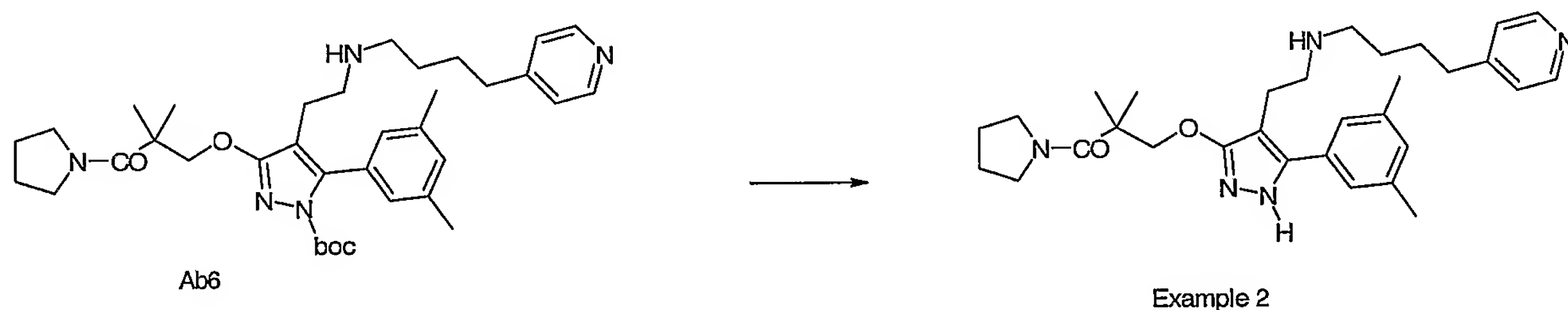
AR6

R	<u>7</u> mg ; mmol	Alcohol mg ; mmol	PPh ₃ mg ; mmol	THF ml	DTAD mg ; mmol	Prod. Form	Mass mg ; Yield %	MS- ESI
	145 ; 0.23	47 ; 0.26	360 ; 1.38	1	205 ; 0.9	nd*	nd*	nd*

5

Example 2

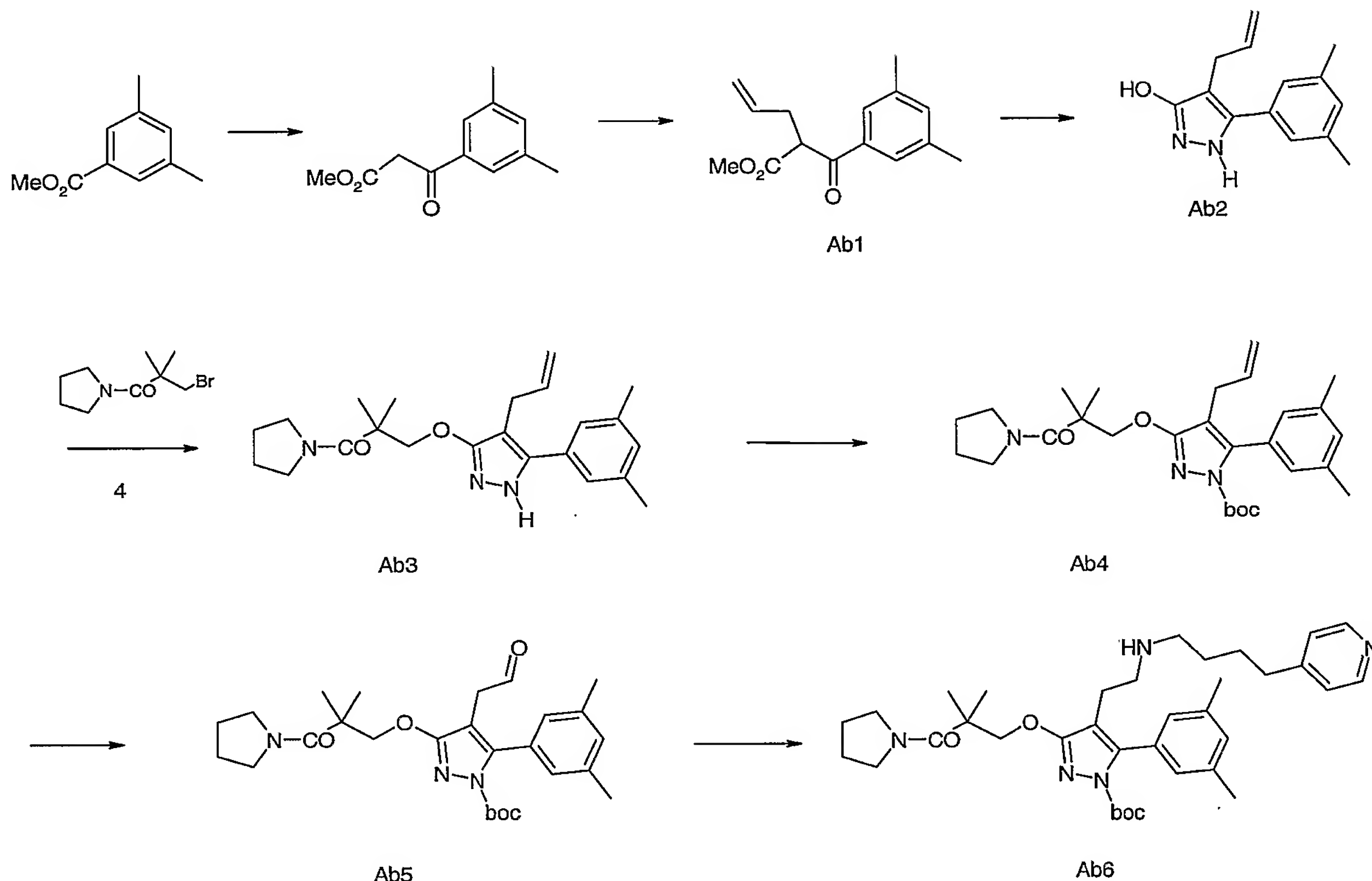
2-[3-(2,2-dimethyl-3-oxo-3-{pyrrolidin-1-yl}propoxy)-5-(3,5-dimethylphenyl)-1H-pyrazol-4-yl]-N-(4-pyridin-4-ylbutyl)ethanamine



- 10 Dry, gaseous HCl was bubbled through a solution of **Ab6** (180 mg ; 0.29 mmol) in CH₂Cl₂ (30 ml) until no Ab6 remained. The mixture was treated with iced sat. aq. NaHCO₃, extracted with CH₂Cl₂ and the organic phase was washed with water, brine and dried over MgSO₄. The residue was purified by flash chromatography eluting with increasingly polar mixtures of ammonia in MeOH(7N)/CH₂Cl₂ (0 to 10% ammonia in MeOH) to give **Example 2** (114 mg).
- 15 Yield : 76%

¹H NMR spectrum (CDCl₃) : 1.38 (s, 6H) ; 1.45 (m, 2H) ; 1.6 (m, 2H) ; 1.84 (m, 4H) ; 2.33 (s, 6H) ; 2.59 (m, 4H) ; 2.65 (t, 2H) ; 2.77 (t, 2H) ; 3.57 ; (m, 4H) ; 4.32 (s, 2H) ; 7.01 (s, 1H) ; 7.04 (s, 2H) ; 7.08 (d, 2H) ; 8.47 (d, 2H) ; 11.9 (s br, 1H).

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MS-ESI : 518 [M+H]⁺The starting material **Ab6** was prepared as follows:-

5

A solution of methyl 3,5-dimethylbenzoate (50 g ; 300 mmol) in DME (80 ml) was added to a suspension of NaH (26.8 g ; 60% in oil ; 670 mmol) in DME (80 ml) under argon. The mixture was heated to reflux and a solution of methyl acetate (45 g ; 610 mmol) in DME (40 ml) added dropwise. The mixture was heated for a further 4 h under reflux. The mixture was cooled and the excess of NaH destroyed by the dropwise addition of MeOH (40 ml). The mixture was poured into dilute HCl (2N), extracted with Et₂O and the organic phase was washed with water, brine and dried over MgSO₄. The residue was purified by flash chromatography eluting with Et₂O /hexanes (10% Et₂O) to give methyl 4-(3',5'-dimethylphenyl) acetoacetate as a yellow oil (31 g).

15 Yield : 50%

¹H NMR spectrum (CDCl₃) : This compound exists as a 4/1 mixture of keto (k) and enol (e) forms : 2.36 (s, 6H)(e) ; 2.38 (s, 6H)(k) ; 3.76 (s, 3H)(k) ; 3.81 (s, 3H)(e) ; 4.03 (s, 2H)(k) ; 5.65 (s, 1H)(e) ; 7.11 (s, 1H)(e) ; 7.27 (s, 1H)(k) ; 7.4 (s, 2H)(e) ; 7.56 (s, 2H)(k) ; 12.48 (s, 1H)(e).

- 63 -

MS-ESI : 207 [M+H]⁺

NaH (2.44 g ; 60% in oil ; 61 mmol) was added in small portions to a solution of methyl 4-(3',5'-dimethylphenyl) acetoacetate (9.66 g ; 46.9 mmol) in DMF (50 ml) at 0°C under argon.

- 5 The mixture was stirred and allowed to warm to room temperature for 30 min. A solution of allyl bromide (4.05 ml ; 46.9 mmol) in DMF (5 ml) was added dropwise and the mixture stirred for a further 2 h. The mixture was poured into H₂O, extracted with Et₂O and the organic phase was washed with water, brine and dried over MgSO₄. The residue was purified by flash chromatography eluting with Et₂O /hexanes (0 to 15% Et₂O) to give **Ab1** as a pale
10 yellow oil (8.3 g).

Yield : 72%

¹H NMR spectrum (CDCl₃) : 2.39 (s, 6H) ; 2.76 (m, 2H) ; 3.70 (s, 3H) ; 4.43 (t, 1H) ; 5.08 (m, 1H) ; 5.15 (m, 1H) ; 5.82 (m, 1H) ; 7.24 (s, 1H) ; 7.60 (s, 2H).

MS-ESI : 247 [M+H]⁺

15

A solution of **Ab1** (3.4 g ; 13 mmol) in EtOH (30 ml) was treated with hydrazine hydrate (3.9 ml ; 78 mmol) and heated under reflux for 3 h. The EtOH was evaporated and the residue triturated with Et₂O. The precipitate was filtered, washed with H₂O and dried to give **Ab2** as a white powder (2.8 g).

- 20 Yield : 95%

¹H NMR spectrum (CDCl₃ + TFAD) : 2.42 (s, 6H) ; 3.32 (d, 2H) ; 5.11 (d, 1H) ; 5.19 (d, 1H); 5.97 (m, 1H) ; 7.16 (s, 2H) ; 7.24 (s, 1H) ; 10.95 (s br 1H).

MS-ESI : 229 [M+H]⁺

- 25 A mixture of **Ab2** (2.1 g ; 9.2 mmol) and **4** (2.15 g ; 9.2 mmol) in DMA (30 ml) under argon was treated with K₂CO₃ (2.54 g ; 18.4 mmol). The mixture was stirred and heated at 80°C for 2h. The mixture was poured into sat. aq. NaHCO₃, extracted with EtOAc and the organic phase was washed with water, brine and dried over MgSO₄. The residue was purified by flash chromatography eluting with increasingly polar mixtures of EtOAc/CH₂Cl₂ (50 to 100%
30 EtOAc) to give **Ab3** as a pale yellow solid (2.8 g).

Yield : 80%

- 64 -

¹H NMR spectrum (CDCl₃) : 1.35 (s, 6H) ; 1.8 (m, 4H) ; 2.32 (s, 6H) ; 3.14 (m, 2H) ; 3.55 (m, 4H) ; 4.18 (s, 2H) ; 4.97 (m, 2H) ; 5.89 (m, 1H) ; 7.02 (s, 1H) ; 7.03 (s, 2H) ; 8.9 (br s, 1H).

MS-ESI : 382 [M+H]⁺

- 5 A mixture of **Ab3** (2.59 g ; 6.8 mmol) and (BOC)₂O (7.4 g ; 34 mmol) in CH₃CN (80 ml) was treated with Et₃N (1.9 ml ; 13.6 mmol). The mixture was heated at 80°C for 3h. The solvent was evaporated, the mixture was poured into sat. aq. NaHCO₃, extracted with Et₂O and the organic phase was washed with water, brine and dried over MgSO₄. The residue was purified by flash chromatography eluting with increasingly polar mixtures of EtOAc/CH₂Cl₂ (0 to 10 25% EtOAc) to give **Ab4** as a white solid (2.51 g).

Yield : 76%

¹H NMR spectrum (CDCl₃) : 1.18 (s, 9H) ; 1.34 (s, 6H) ; 1.8 (m, 4H) ; 2.3 (s, 6H) ; 2.85 (m, 2H) ; 3.54 (m, 4H) ; 4.43 (s, 2H) ; 4.87 (m, 2H) ; 5.73 (m, 1H) ; 6.8 (s, 2H) ; 6.98 (s, 1H).

MS-ESI : 482 [M+H]⁺

15

- 4-Methyl-morpholine-N-oxide (1.6 ml ; 60% solution in H₂O) was added to a solution of **Ab4** (2.21 g ; 4.6 mmol) in THF (100 ml) and H₂O (30 ml). The mixture was cooled to 0°C and a solution of OsO₄ (92 mg ; 0.36 mmol) in *t*-BuOH (1.8 ml) was added dropwise. The mixture was allowed to warm to room temperature for 6 h. The reaction was quenched by the 20 addition of aq. Na₂S₂O₅ (1.75g) in H₂O (50 ml). The THF was evaporated and the mixture extracted with EtOAc. The organic phase was washed with water, brine and dried over MgSO₄. The residue (2.21 g) was taken up in THF (100 ml) and H₂O (30 ml) and treated with NaIO₄. The mixture was stirred overnight. The THF was evaporated and the mixture extracted with EtOAc. The organic phase was washed with water, brine and dried over MgSO₄. The 25 residue was purified by flash chromatography eluting with increasingly polar mixtures of EtOAc/CH₂Cl₂ (0 to 50% EtOAc) to give **Ab5** as a buff solid (1.63 g).

Yield : 73%

¹H NMR spectrum (CDCl₃) : 1.21 (s, 9H) ; 1.34 (s, 6H) ; 1.9 (m, 4H) ; 2.32 (s, 6H) ; 3.23 (d, 2H) ; 3.55 (m, 4H) ; 4.47 (s, 2H) ; 6.8 (s, 2H) ; 7.01 (s, 1H) ; 9.56 (d, 1H).

30 MS-ESI : 484 [M+H]⁺

A solution of **Ab5** (360 mg ; 0.74 mmol) and 4-(4-aminobutyl)-pyridine (123 mg ; 0.82 mmol) in MeOH (6 ml) was treated with NaBH₃CN (52 mg ; 0.82 mmol). The mixture was

- 65 -

cooled to 0°C and acetic acid (45 μ l ; 0.82 mmol) was added. The mixture was allowed to warm to room temperature for 2 h and evaporated. The residue was treated with aq. K₂CO₃ (10%) and the mixture extracted with EtOAc. The organic phase was washed with water, brine and dried over MgSO₄. The residue was purified by flash chromatography eluting with 5 EtOAc and then increasingly polar mixtures of MeOH/CH₂Cl₂ (0 to 5% MeOH) to give **Ab6** as an oil (180 mg).

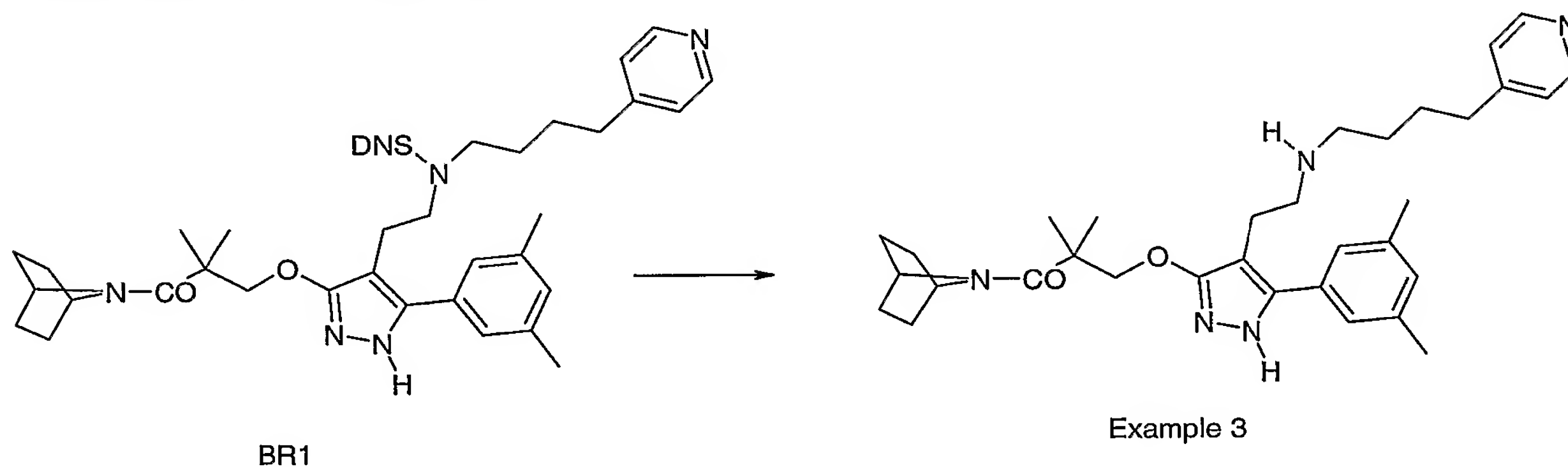
Yield : 40%

¹H NMR spectrum (CDCl₃) : 1.20 (s, 9H) ; 1.37 (s, 6H) ; 1.61 (m, 2H) ; 1.87 (m, 6H) ; 2.31 (s, 6H) ; 2.48 (m, 2H) ; 2.62 (m, 4H) ; 2.76 (m, 2H) ; 3.57 (m, 4H) ; 4.45 (s, 2H) ; 6.8 (s, 2H) ; 7.0 (s, 1H) ; 7.08 (d, 2H) ; 8.47 (d, 2H).

MS-ESI : 618 [M+H]⁺

Example 3

2-[3-(2,2-dimethyl-3-oxo-3-{azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1H-pyrazol-4-yl]-N-(4-pyridin-4-ylbutyl)-ethanamine



A solution of **BR1** (322 mg ; 0.41 mmol) in CH₂Cl₂ (5 ml) was treated dropwise with propylamine (340 μ l ; 4.1 mmol). The mixture was stirred at room temperature for 1h and then purified directly by flash chromatography eluting with increasingly polar mixtures of MeOH/CH₂Cl₂ (0 to 10% MeOH) to give **Example 3** as a white solid (219 mg).

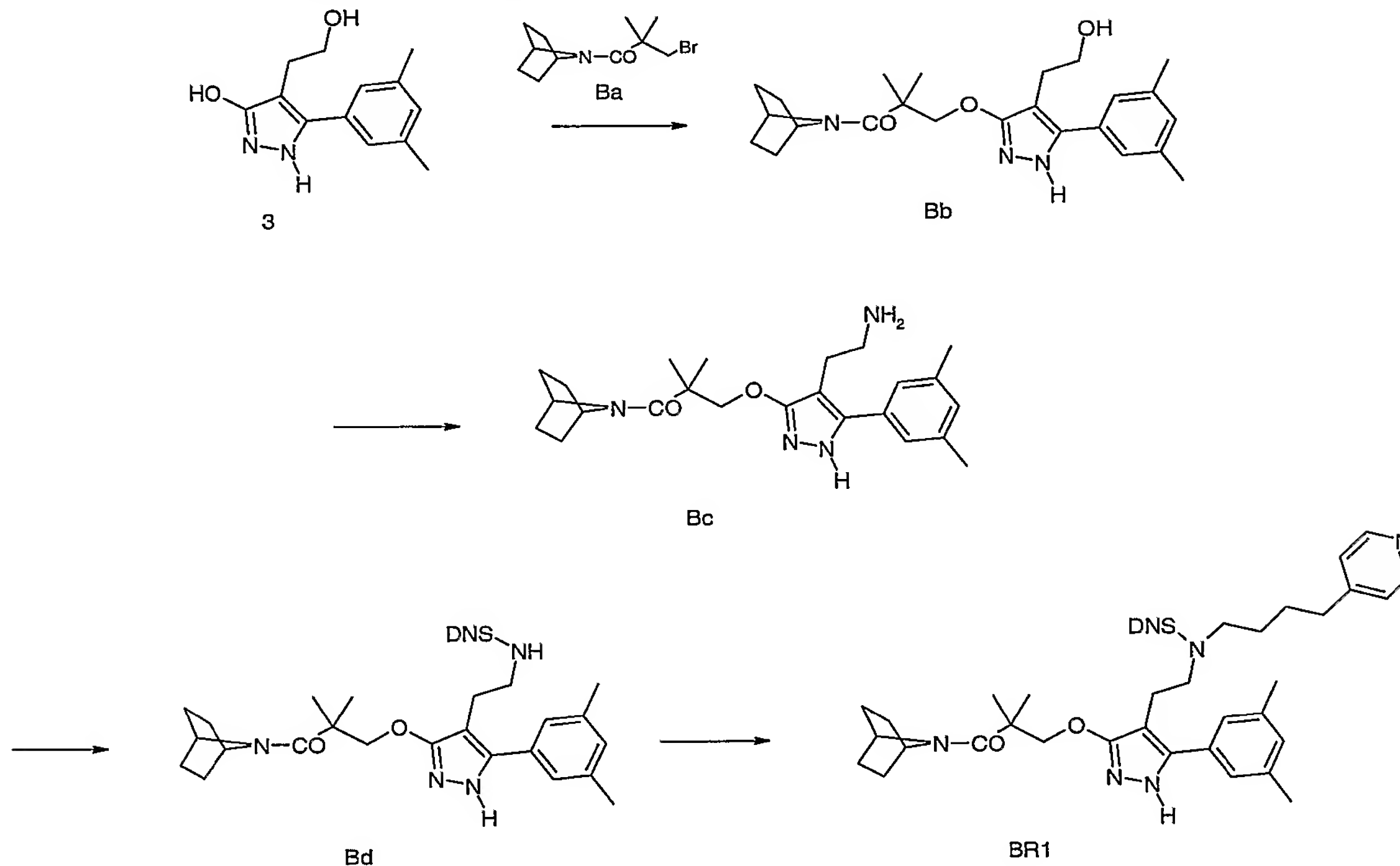
Yield : 98 %

¹H NMR spectrum (DMSO d₆) : 1.25 (s, 6H) ; 1.43 (m, 6H) ; 1.61 (m, 6H) ; 2.3 (s, 6H) ; 2.59 (m, 4H) ; 2.65 (m, 2H) ; 2.75 (m, 2H) ; 4.16 (s, 2H) ; 4.57 (s, 2H) ; 7.02 (s, 1H) ; 7.11 (s, 2H) ; 7.21 (d, 2H) ; 8.44 (m, 2H) ; 11.8 (s br 1H).

MS-ESI : 544 [M+H]⁺

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Starting material **BR1** was prepared as follows:-



A mixture of **3** (4.64 g ; 20 mmol) and **Ba** (5.72 g ; 22 mmol) in DMA (50 ml) under argon was treated with K_2CO_3 (5.52 g ; 40 mmol). The mixture was stirred and heated at 70°C for 6h. The mixture was poured into sat. aq. $NaHCO_3$, extracted with EtOAc and the organic phase was washed with water, brine and dried over $MgSO_4$. The residue was purified by flash chromatography eluting with increasingly polar mixtures of EtOAc/ CH_2Cl_2 (0 to 50% EtOAc) to give the alcohol **Bb** as a pale yellow oil (7.58 g).

Yield : 92%

1H NMR spectrum ($DMSO-d_6$) : 1.25 (s, 6H) ; 1.42 (m, 4H) ; 1.62 (m, 4H) ; 2.31 (s, 6H) ; 2.53 (m, 2H) ; 3.46 (m, 2H) ; 4.14 (s, 2H) ; 4.58 (s, 2H) ; 4.61 (t, 1H) ; 7.02 (s, 1H) ; 7.14 (s, 2H) ; 11.9 (br s, 1H).

MS-ESI : 412 $[M+H]^+$

A mixture of **Bb** (3.29 g ; 8 mmol), phthalimide (2.35 g ; 16 mmol) and triphenylphosphine (12.5 g ; 48 mmol) in THF (50 ml) was cooled to -20°C under argon and treated dropwise with DEAD (7.6 ml ; 48 mmol). The mixture was allowed to warm to 10°C for 1h when water was added and the THF evaporated. The mixture was extracted with EtOAc and the organic phase was washed with water, brine and dried over $MgSO_4$.

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Evaporation gave a crude solid which, without further purification, was immediately taken up in EtOH (200 ml) and treated with hydrazine hydrate (16 ml ; 320 mmol). The mixture was stirred for 2h and then the EtOH was partially evaporated. Addition of CH₂Cl₂ caused precipitation of phthalhydrazide which was filtered and rinsed with CH₂Cl₂. The filtrate was
5 evaporated and the residue was purified by flash chromatography eluting with increasingly polar mixtures of EtOAc and then MeOH/CH₂Cl₂ (0 to 10% MeOH) to give **Bc** as a pale beige solid (2.53 g).

Yield : 77%

¹H NMR spectrum (DMSO d₆) : 1.25 (s, 6H) ; 1.42 (m, 4H) ; 1.62 (m, 4H) ; 2.31 (s, 6H) ;
10 2.46 (m, 2H) ; 2.65 (t, 2H) ; 4.15 (s, 2H) ; 4.58 (m, 2H) ; 7.01 (s, 1H) ; 7.12 (s, 2H) ; 11.8 (s
br 1H).

MS-ESI : 411 [M+H]⁺

A solution of **Bc** (1.43 g ; 3.48 mmol) in CH₂Cl₂ (30 ml) was treated with
15 diisopropylethylamine (910 μl ; 5.22 mmol) and cooled to 0°C. A solution of 2,4-
dinitrobenzenesulphonyl chloride (1.02 g ; 3.84 mmol) in CH₂Cl₂ (10 ml) was added dropwise
and the mixture was allowed to warm to room temperature for 30 min. The mixture was
poured into sat. aq. NaHCO₃, extracted with EtOAc and the organic phase was washed with
water, brine and dried over MgSO₄. The residue was purified by flash chromatography
20 eluting with increasingly polar mixtures of EtOAc/CH₂Cl₂ (0 to 20% EtOAc) to give **Bd** as a
cream solid (1.1 g).

Yield : 50%

¹H NMR spectrum (DMSO d₆) : 1.22 (s, 6H) ; 1.41 (m, 4H) ; 1.59 (s, 4H) ; 2.3 (s, 6H) ; 2.57
(m, 2H) ; 3.11 (m, 2H) ; 4.12 (s, 2H) ; 4.55 (s, 2H) ; 7.0 (s, 1H) ; 7.03 (s, 2H) ; 8.17 (d, 1H) ;
25 8.59 (m, 2H) ; 8.83 (d, 1H) ; 11.8 (s br 1H).

MS-ESI : 641 [M+H]⁺

A mixture of **Bd** (300 mg ; 0.43 mmol), 4-(4-hydroxybutyl)-pyridine (84 mg ; 0.56 mmol)
and triphenylphosphine (495 mg ; 1.87 mmol) in THF (10 ml) at 0°C under argon was treated
30 dropwise with DEAD (300 μl ; 1.87 mmol). The mixture was allowed to warm to room
temperature for 30 min. when water was added. The THF was evaporated, the mixture
extracted with EtOAc and the organic phase washed with water, brine and dried over MgSO₄.

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The residue was purified by flash chromatography eluting with increasingly polar mixtures of EtOAc/CH₂Cl₂ (0 to 100% EtOAc) **BR1** as a white solid (322 mg).

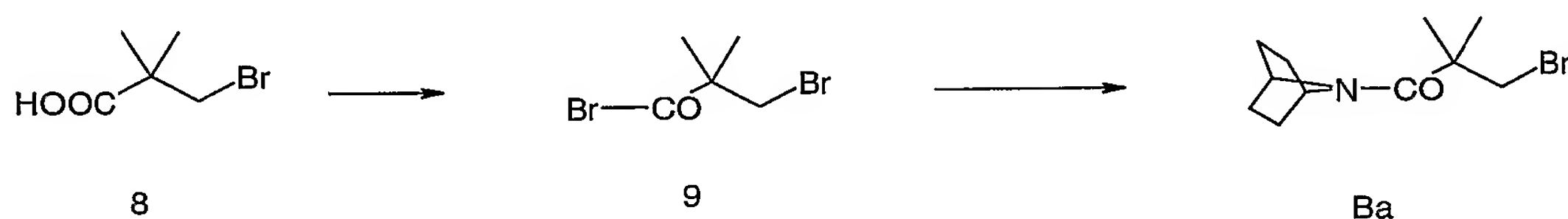
Yield : 89%

¹H NMR spectrum (DMSO d₆) : 1.24 (s, 6H) ; 1.38 (m, 4H) ; 1.54 (m, 8H) ; 2.29 (s, 6H) ;

5 2.57 (m, 2H) ; 2.64 (m, 2H) ; 3.36 (m, 4H) ; 4.18 (s, 2H) ; 4.52 (m, 2H) ; 7.02 (s, 1H) ; 7.08 (s, 2H) ; 7.16 (d, 2H) ; 8.20 (d, 1H) ; 8.41 (d, 2H) ; 8.47 (dd, 1H) ; 8.91 (d, 1H) ; 11.8 (s br 1H).

MS-ESI : 774 $[M+H]^+$

10 Starting material **Ba** was prepared as follows:-



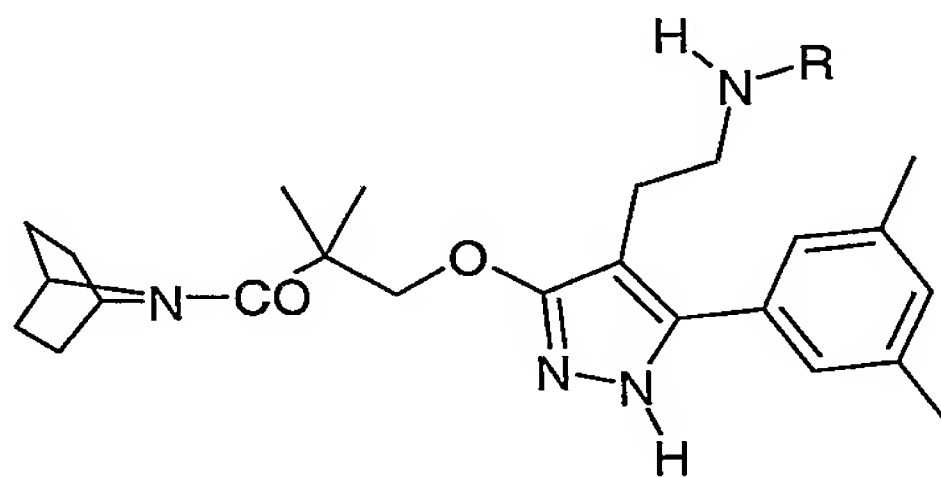
A mixture of **8** (14.48 g ; 80 mmol) and oxalyl bromide (43.2 g ; 200 mmol) containing one drop of DMF was heated at 50°C for 2h and then cooled. The excess of oxalyl bromide was evaporated and the residue azeotroped with toluene to give crude **9** which was taken up in 15 CH₂Cl₂ (25 ml) and cooled to 0°C. Diisopropylethylamine (14 ml ; 80 mmol) was added followed by 2.2.1-azabicycloheptane hydrochloride (5.34 g ; 40 mmol). The mixture was allowed to warm to room temperature overnight and was diluted with CH₂Cl₂, washed with aq. HCl (2N), aq. NaOH (1N), water, brine and dried over MgSO₄. The residue was purified by flash chromatography eluting with CH₂Cl₂ to give **Ba** as a white solid (7.4 g).

20 Yield : 71%

¹H NMR spectrum (CDCl₃) : 1.36 (s, 6H) ; 1.49 (m, 4H) ; 1.82 (m, 4H) ; 3.59 (s, 2H) ; 4.61 (s, 2H).

Examples 3.1-3.5

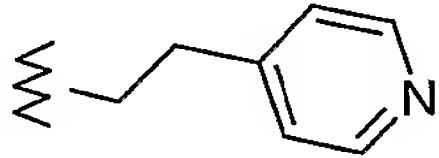
25 The following examples were prepared in a similar manner to Example 3,



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the table shows the **R** group relating to the above structure, the reaction conditions and characteristics for each example, corresponding to the description of the preparation of Example 3 given above:-

5 **Example 3.1**

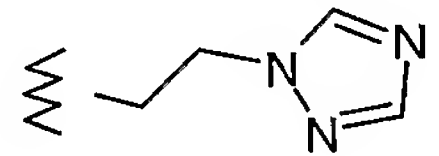
R	BR2 mg ; mmol	CH ₂ Cl ₂ ml	Propylamine μ l ; mmol	Mass mg ; Yield	MS- ESI
	292 ; 0.39	5	320 ; 3.9	161 ; 80%	516 [M+H] +

Chromato. - MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (DMSO d₆) : 1.25 (s, 6H) ; 1.41 (m, 4H) ; 1.6 (m, 4H) ; 2.29 (s, 6H) ; 2.55 (m, 2H) ; 2.71 (m, 4H) ; 2.81 (m, 2H) ; 4.15 (s, 2H) ; 4.56 (s, 2H) ; 7.02 (s, 1H) ; 7.10 (s, 2H) ; 7.2 (d, 2H) ; 8.43 (dd, 2H) ; 11.7 (s br 1H).

10

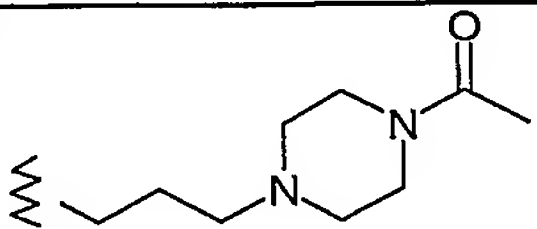
Example 3.2

R	BR3 mg ; mmol	CH ₂ Cl ₂ ml	Propylamine μ l ; mmol	Mass mg ; Yield	MS- ESI
	123 ; 0.17	3	140 ; 1.67	58 ; 68%	506 [M+H] +

Chromato. - MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (DMSO d₆) : 1.25 (s, 6H) ; 1.42 (m, 4H) ; 1.61 (m, 4H) ; 2.3 (s, 6H) ; 2.46 (m, 2H) ; 2.64 (m, 2H) ; 2.88 (m, 2H) ; 4.15 (s, 2H) ; 4.19 (t, 2H) ; 4.57 (s, 2H) ; 7.01 (s, 1H) ;
15 7.09 (s, 2H) ; 7.92 (s, 1H) ; 8.42 (s, 1H) ; 11.9 (s br, 1H).

Example 3.3

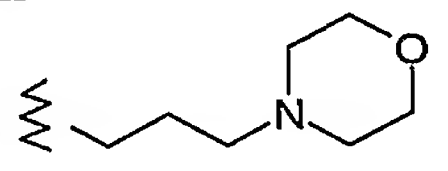
R	BR4 mg ; mmol	CH ₂ Cl ₂ ml	Propylamine μ l ; mmol	Mass mg ; Yield	MS- ESI
	96 ; 0.12	3	140 ; 1.67	50 ; 72%	579 [M+H] +

Chromato. - EtOAc and then MeOH/CH₂Cl₂ (0 to 10% MeOH)

- 70 -

^1H NMR spectrum (DMSO d_6) : 1.26 (s, 6H) ; 1.44 (m, 4H) ; 1.61 (m, 6H) ; 1.97 (s, 3H) 2.25 (s, 2H) ; 2.32 (s, 6H) ; 2.4-2.85 (m, 14H) ; 4.16 (s, 2H) ; 4.58 (s, 2H) ; 7.04 (s, 1H) ; 7.11 (s, 2H) ; 11.8 (s, 1H).

5 Example 3.4

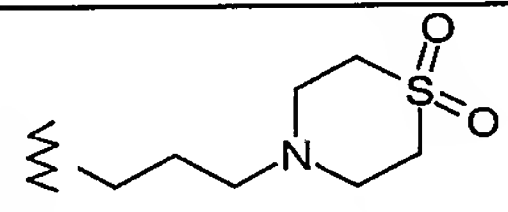
R	BR5 mg ; mmol	CH_2Cl_2 ml	Propylamine μl ; mmol	Mass mg ; Yield	MS-ESI
	167 ; 0.22	3	180 ; 2.2	30 ; 25%	538 [M+H] ⁺

Chromato. – EtOAc and then MeOH/ CH_2Cl_2 (0 to 10% MeOH)

^1H NMR spectrum (DMSO d_6) : 1.26 (s, 6H) ; 1.44 (m, 4H) ; 1.57 (m, 2H) ; 1.62 (m, 4H) ; 2.27 (m, 6H) ; 2.32 (s, 6H) ; 2.5-2.85 (m, 6H) ; 3.52 (s, 4H) ; 4.16 (s, 2H) ; 4.58 (s, 2H) ; 7.03 (s, 1H) ; 7.12 (s, 2H) ; 11.8 (s, 1H).

10

Example 3.5

R	BR6 mg ; mmol	CH_2Cl_2 ml	Propylamine μl ; mmol	Mass mg ; Yield	MS-ESI
	194 ; 0.24	3	195 ; 2.4	93 ; 66%	586 [M+H] ⁺

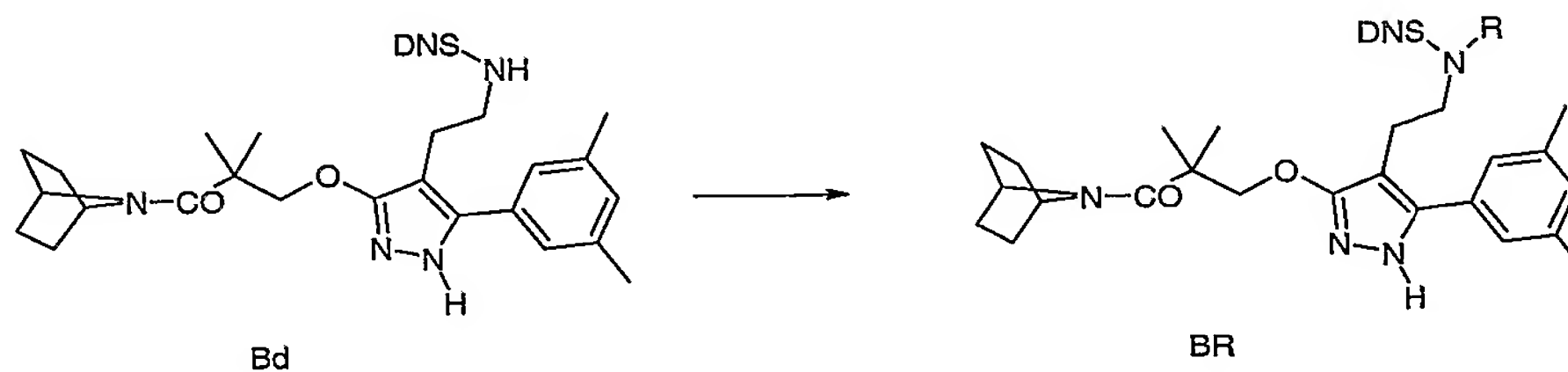
Chromato. – EtOAc and then MeOH/ CH_2Cl_2 (0 to 10% MeOH)

^1H NMR spectrum (DMSO d_6) : 1.26 (s, 6H) ; 1.44 (m, 4H) ; 1.55 (m, 2H) ; 1.61 (m, 4H) ; 2.32 (s, 6H) ; 2.4-2.85 (m, 8H) ; 2.82 (s, 4H) ; 3.04 (m, 4H) ; 4.16 (s, 2H) ; 4.58 (s, 2H) ; 7.03 (s, 1H) ; 7.12 (s, 2H) ; 11.8 (s, 1H).

Intermediates for Examples 3.1-3.5, BR2 – BR6 respectively

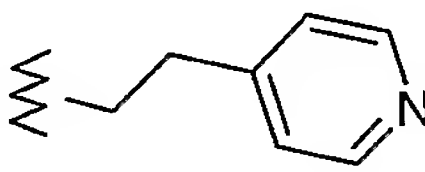
Starting materials **BR2-6** were prepared as follows, the table showing the reaction conditions and characteristics for each example, corresponding to the description of **Example 3** given

20 above:-

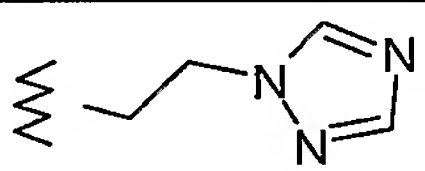


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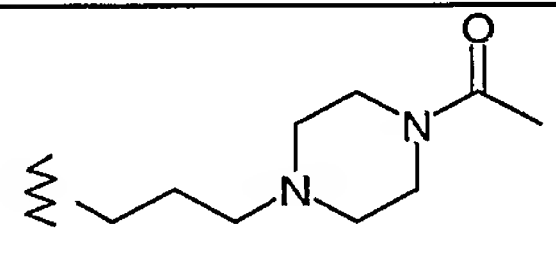
BR2

R	Bd mg ; mmol	Alcohol mg ; mmol	PPh ₃ mg ; mmol	THF ml	DEAD μ l ; mmol	Mass mg ; Yield	MS- ESI
	300 ; 0.47	70 ; 0.56	495 ; 1.87	10	290 ; 1.84	292 ; 83%	746 [M+H] ⁺

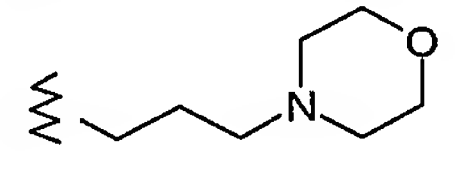
Chromato. - EtOAc/CH₂Cl₂ (0 to 100% EtOAc)**BR3**

R	Bd mg ; mmol	Alcohol mg ; mmol	PPh ₃ mg ; mmol	THF ml	DEAD μ l ; mmol	Mass mg ; Yield	MS- ESI
	150 ; 0.23	32 ; 0.28	362 ; 1.38	5	145 ; 0.92	123 ; 72%	736 [M+H] ⁺

5 Chromato. - EtOAc/CH₂Cl₂ (0 to 100% EtOAc)**BR4**

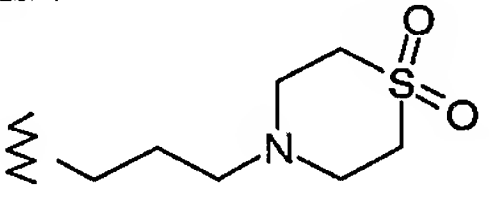
R	Bd mg ; mmol	Alcohol mg ; mmol	PPh ₃ mg ; mmol	THF ml	DEAD μ l ; mmol	Mass mg ; Yield	MS- ESI
	150 ; 0.23	53 ; 0.28	362 ; 1.38	5	200 ; 1.26	96 ; 51%	809 [M+H] ⁺

Chromato. - EtOAc/CH₂Cl₂ (0 to 100% EtOAc) and then MeOH/CH₂Cl₂ (0 to 10% MeOH)10 **BR5**

R	Bd mg ; mmol	Alcohol mg ; mmol	PPh ₃ mg ; mmol	THF ml	DEAD μ l ; mmol	Mass mg ; Yield %	MS- ESI
	200 ; 0.31	54 ; 0.37	490 ; 1.86	5	270 ; 1.72	167 ; 70%	768 [M+H] ⁺

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Chromato. – EtOAc and then MeOH/CH₂Cl₂ (0 to 10% MeOH)**BR6**

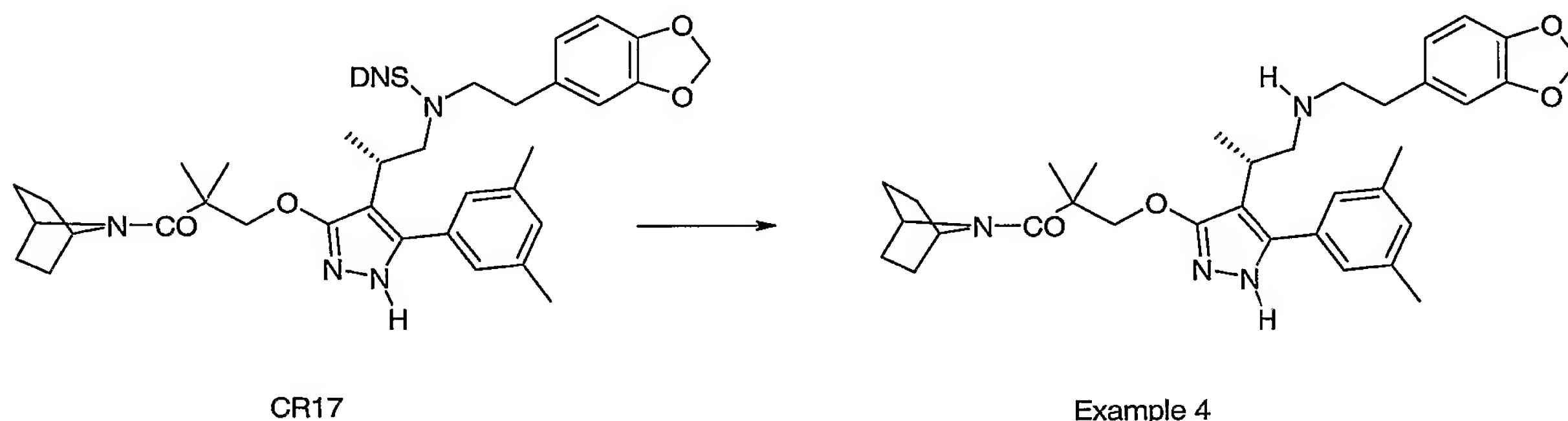
R	Bd mg ; mmol	Alcohol mg ; mmol	PPh ₃ mg ; mmol	THF ml	DEAD μl ; mmol	Mass mg ; Yield %	MS- ESI
	200 ; 0.31	72 ; 0.37	490 ; 1.86	5	270 ; 1.72	194 ; 77%	816 [M+ H] ⁺

Chromato. – EtOAc and then MeOH/CH₂Cl₂ (0 to 10% MeOH).

5

Example 4

2-[3-(2,2-dimethyl-3-oxo-3-azabicyclo[2.2.1]heptan-7-ylpropoxy)-5-(3,5-dimethylphenyl)-1H-pyrazol-4-yl]-N-[2-(1,3-benzodioxol-5-yl)ethyl]-(2S)-propylamine



- 10 A solution of partially purified* **Cg17** (4.2 g ; from 2.3 mmol of **Cf**) in CH₂Cl₂ (30 ml) under nitrogen was treated dropwise with n-propylamine (1.36 ml ; 23 mmol) at room temperature. The mixture was stirred at room temperature for 2h, the solvents evaporated and the residue purified directly by flash chromatography eluting with increasingly polar mixtures of EtOAc and then MeOH/CH₂Cl₂ (0 to 15% MeOH) to give **Example 4** as a beige solid (768 mg).

- 15 *Contains some Ph₃PO

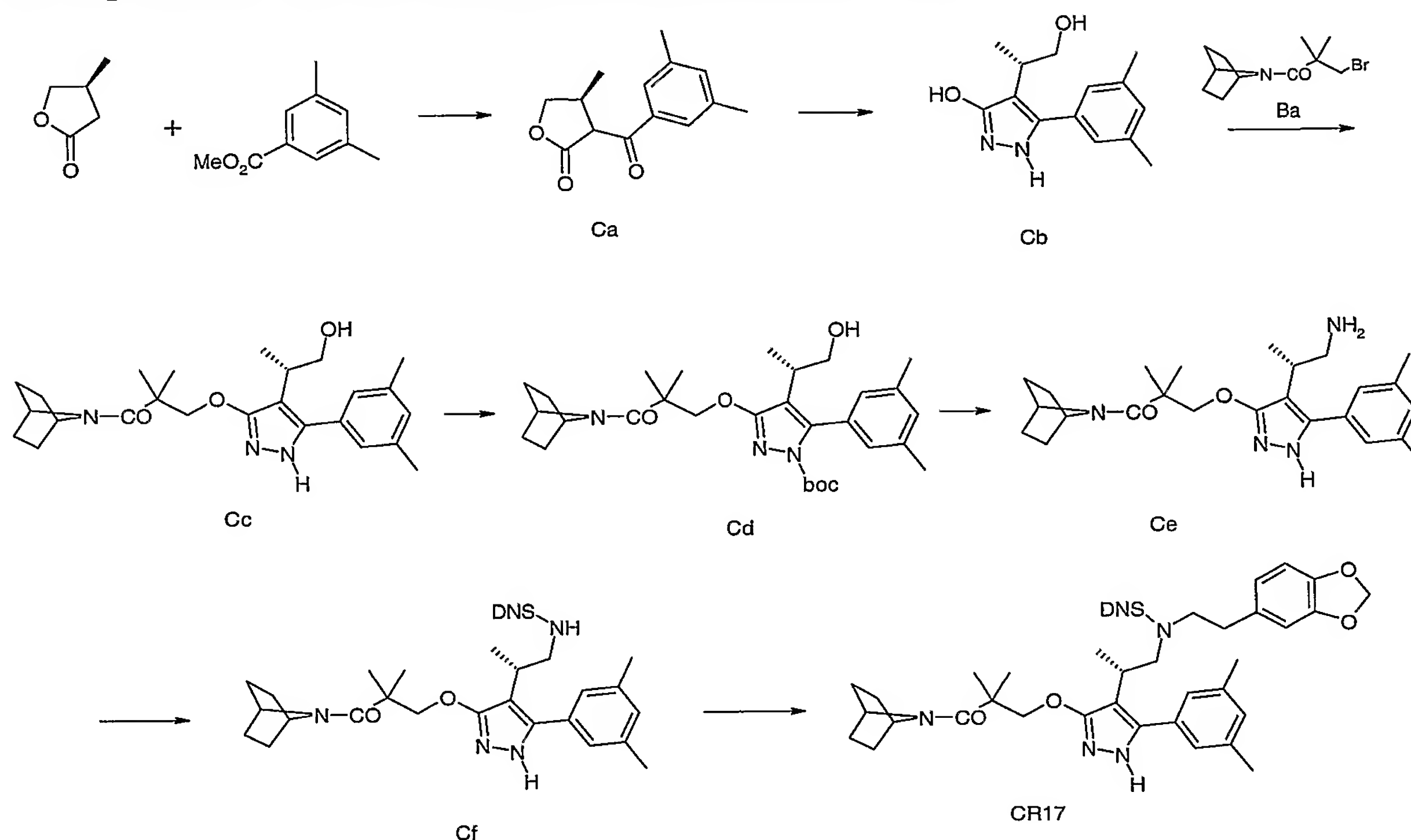
Yield : 59% for last two steps.

¹H NMR spectrum (DMSO d₆) : 1.13 (d, 3H) ; 1.25 (s, 6H) ; 1.42 (m, 4H) ; 1.60 (m, 4H) ; 2.3 (s, 6H) ; 2.55-2.95 (m, 7H) ; 4.14 (s, 2H) ; 4.57 (s, 2H) ; 5.94 (s, 2H) ; 6.55 (d, 1H) ; 6.69 (s, 1H) ; 6.76 (d, 1H) ; 7.03 (s, 1H) ; 7.04 (s, 2H) ; 11.8 (s br 1H).

- 20 MS-ESI : 573 [M+H]⁺

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Starting materials **Ce**, **Cf** and **CR17** were prepared as follows:-



A solution of methyl 3,5-dimethylbenzoate (148 g ; 0.9 mol) and 3S-methylbutyrolactone (90 g ; 0.9 mol) in THF (2.4 l) under argon was cooled to 0°C and treated dropwise rapidly with 5 LHMDS (1.35 l ; 1.35 mol ; 1M in hexanes). The mixture was stirred for 2h while the temperature was maintained below 10°C. The mixture was poured into dilute HCl (2N, 800ml) at 0°C. Further dilute HCl (2N) was added until the pH reached 1.6. The THF was evaporated and the residual aqueous phase was extracted with EtOAc. The organic phase was washed with sat. aq. NaHCO₃, brine and dried over MgSO₄. The residue was purified by flash chromatography eluting with increasingly polar mixtures of EtOAc/hexanes (10 to 15% EtOAc) to give **Ca** as a colourless oil (127.7 g).

Yield : 61%.

¹H NMR spectrum (DMSO d₆) : 1.09 (td, 3H) ; 2.36 (s, 6H) ; 3.05 (m, 1H) ; 3.93 (t, 1H) ; 4.50 (t, 1H) ; 4.78 (d, 1H) ; 7.36 (s, 1H) ; 7.67 (s, 2H).

15 MS-ESI : 233 [M+H]⁺

Compound **Ca** (127.5 g ; 0.55 mol) was dissolved in EtOH (2.0 l) and hydrazine hydrate (27 ml ; 0.55 mol) was added. The mixture was stirred overnight at room temperature. Dilute HCl (12N ; 12 ml) was added and the mixture stirred for a further 1h. The precipitate was filtered

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to give **Cb** as a white solid (63 g). Crystallisation from the mother liquors yielded further batches of **Cb** (29 g).

Yield : 68%

¹H NMR spectrum (DMSO d₆) : 1.15 (d, 3H) ; 2.23 (s, 6H) ; 2.77 (m, 1H) ; 3.53 (d, 2H) ; 4.77
5 (br s, 1H) ; 7.01 (s, 1H) ; 7.04 (s, 2H) ; 9.5 (br s, 1H).

MS-ESI : 247 [M+H]⁺

A mixture of **Cb** (50 g ; 0.20 mol) and **Ba** (60 g ; 0.23 mol) in DMA (350 ml) under argon was treated with K₂CO₃ (56 g ; 0.41 mol). The mixture was stirred and heated at 80°C
10 overnight. The mixture was cooled and poured into a stirred mixture of sat. aq. NaHCO₃/H₂O (1:2.5). The precipitate was filtered, washed abundantly with water and dried, to give the alcohol **Cc** as a pale beige solid. (84.5 g).

Yield : 99%

¹H NMR spectrum (DMSO d₆) : 1.12 (d, 3H) ; 1.25 (s, 6H) ; 1.42 (m, 4H) ; 1.62 (m, 4H) ;
15 2.31 (s, 6H) ; 2.75 (m, 1H) ; 3.46 (m, 2H) ; 4.14 (m, 2H) ; 4.51 (br s, 1H) ; 4.58 (m, 2H) ; 7.03 (s, 1H) ; 7.06 (s, 2H) ; 11.9 (br s, 1H).

MS-ESI : 426 [M+H]⁺

A solution of **Cc** (42 g ; 0.1 mol) in CH₂Cl₂ (800 ml) under argon was treated with
20 acetonitrile (3 l) and DMAP (250 mg ; cat.). The mixture was stirred and cooled to 0°C and a solution of BOCBOC (24 g ; 0.11 mol) in acetonitrile (100 ML) was added slowly, dropwise. The mixture was allowed to warm to room temperature until no **Cc** remained (~1 day) and was poured into water (2 l) and stirred for 4 h. The organic solvents were
25 evaporated. The mixture was extracted with CH₂Cl₂ and the organic phase was washed with water, brine and dried over MgSO₄. The residue was purified by flash chromatography eluting with increasingly polar mixtures of EtOAc/ CH₂Cl₂ (20 to 50% EtOAc) to give **Cd** as a colourless foam (25.5 g).

Yield : 50%

¹H NMR spectrum (DMSO d₆) : 1.02 (d, 3H) ; 1.16 (s, 9H) ; 1.270 (s, 6H) ; 1.44 (m, 4H) ;
30 1.62 (m, 4H) ; 2.29 (s, 6H) ; 2.33 (m, 1H) ; 3.38 (m, 2H) ; 4.23 (m, 2H) ; 4.54 (m, 1H) ; 4.59 (s, 2H) ; 6.89 (s, 1H) ; 7.05 (s, 2H).

MS-ESI : 526 [M+H]⁺

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A solution of **Cd** (50.9 g ; 97 mmol), phthalimide (17 g ; 116 mmol) and triphenyl phosphine (38 g ; 145 mmol) in THF (1 l) under argon was cooled to 0°C and treated rapidly, portionwise with DTAD (33.3 g ; 145 mmol). The mixture was allowed to warm to room temperature for 2 h 30 min. Water (500 ml) was added to the mixture and the organic solvent
5 evaporated. The mixture was extracted with CH₂Cl₂ and the organic phase was washed with water, brine and dried over MgSO₄. The residue was purified by flash chromatography eluting with increasingly polar mixtures of EtOAc/CH₂Cl₂ (0 to 15% EtOAc) to give a cream foam (48.4 g) which was dissolved in EtOH (1.5 l). The mixture was treated with hydrazine hydrate (143 ml ; 2.95 mol) at room temperature and was stirred for a further 26 h. The precipitate
10 was filtered and the residue purified by flash chromatography eluting with increasingly polar mixtures of MeOH/CH₂Cl₂ (5 to 15% MeOH) to give **Ce** as a white solid (31.4 g).

Yield : 77%

¹H NMR spectrum (DMSO d₆) : 1.12 (d, 3H) ; 1.25 (s, 6H) ; 1.42 (m, 4H) ; 1.61 (m, 4H) ; 2.31 (s, 6H) ; 2.63 (m, 2H) ; 2.72 (m, 1H) ; 4.15 (m, 2H) ; 4.57 (m, 2H) ; 7.02 (s, 1H) ; 7.06
15 (s, 2H) ; 8.9 (br s, 1H).

MS-ESI : 425 [M+H]⁺

A solution of **Ce** (1.5g ; 3.58 mmol) in THF (70 ml) was cooled to 0°C under argon. DIEA (810 µl ; 4.65 mmol) was added followed by a solution of DNOSCl (1.04 g ; 3.9 mmol) in
20 THF (20 ml). The mixture was allowed to warm to room temperature for 2 h and was treated with aq. HCl (1N). The mixture was extracted with CH₂Cl₂ and the organic phase was washed with water, brine and dried over MgSO₄. The residue was purified by flash chromatography eluting with increasingly polar mixtures of EtOAc/CH₂Cl₂ (0 to 100% EtOAc) to give **Cf** as a cream foam (2.07 g).

25 Yield : 88%

¹H NMR spectrum (DMSO d₆) : 1.10 (d, 3H) ; 1.23 (s, 6H) ; 1.41 (m, 4H) ; 1.58 (m, 4H) ; 2.29 (s, 6H) ; 2.83 (m, 1H) ; 3.19 (m, 2H) ; 4.13 (m, 2H) ; 4.55 (m, 2H) ; 6.95 (s, 2H) ; 6.98 (s, 1H) ; 8.12 (d, 1H) ; 8.49 (br s, 1H) ; 8.52 (q, 1H) ; 8.79 (d, 1H).

MS-ESI : 655 [M+H]⁺

30

A mixture of **Cf** (1.5 g ; 2.3 mmol), the corresponding alcohol (575 mg ; 3.45 mmol) and triphenylphosphine (3.67 g ; 14 mmol) in THF (50 ml) at 0°C under argon was treated with DTAD (2.12 g ; 9.2 mmol). The mixture was allowed to warm to room temperature for 1 h

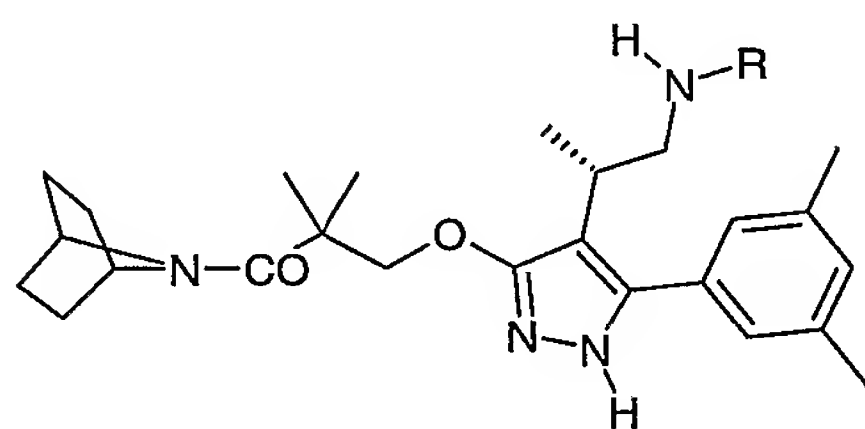
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when water was added. The mixture was extracted with CH_2Cl_2 and the organic phase was washed with water, brine and dried over MgSO_4 . The residue was purified by flash chromatography eluting with increasingly polar mixtures of EtOAc/hexanes (0 to 50%) and then EtOAc/ CH_2Cl_2 (0 to 100% EtOAc) to give **CR17** as a beige solid (4.2 g).

- 5 This partially purified intermediate (containing some Ph_3PO) was used directly in the final step.

Example 4.1-4.54

The following examples were prepared using the same methodology as Example 4,



10

The table shows the **R** group relating to the above structure, the reaction conditions and characteristics of each example, corresponding to the description of the preparation of Example 4 given above: -

15 **Example 4.1**

R	CR1 mg ; mmol Cf	CH_2Cl_2 ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	100 ; 0.13	5	0.11 ; 1.3	53 ; 78%	530 [M+H] ⁺

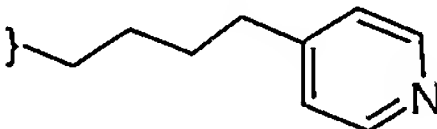
Chromato. – EtOAc and then MeOH/ CH_2Cl_2 (0 to 10% MeOH)

^1H NMR spectrum ($\text{DMSO}-d_6$) : 1.12 (d, 3H) ; 1.25 (s, 6H) ; 1.41 (m, 4H) ; 1.60 (m, 4H) ; 2.28 (s, 6H) ; 2.6-2.9 (m, 7H) ; 4.14 (s, 2H) ; 4.57 (s, 2H) ; 7.03 (s, 3H) ; 7.12 (d, 2H) ; 8.39 (d, 2H) ; 11.8 (s br 1H).

20

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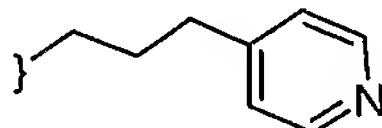
Example 4.2

R	CR2 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS- ESI
	202 ; 0.25	3	0.21 ; 2.5	130 ; 91%	558 [M+H] ⁺

Chromato. - EtOAc and then MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (DMSO d₆) : 1.14 (d, 3H) ; 1.25 (s, 6H) ; 1.35 (m, 2H) ; 1.42 (m, 4H) ;
 1.53 (m, 2H) ; 1.61 (m, 4H) ; 2.29 (s, 6H) ; 2.5-2.95 (m, 7H) ; 4.15 (s, 2H) ; 4.57 (s, 2H) ;
 5 7.03 (s, 1H) ; 7.05 (s, 2H) ; 7.17 (d, 2H) ; 8.42 (d, 2H) 11.8 (s br 1H).

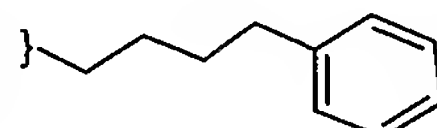
Example 4.3

R	CR3 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS- ESI
	68 ; 0.09	3	0.08 ; 0.88	42 ; 87%	544 [M+H] ⁺

Chromato. - EtOAc and then MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (DMSO d₆ – TFAd) : 1.25 (m, 9H) ; 1.43 (m, 4H) ; 1.60 (m, 4H) ; 1.97 (m,
 10 2H) ; 2.32 (s, 6H) ; 2.8-3.15 (m, 7H) ; 4.20 (s, 2H) ; 4.55 (s, 2H) ; 7.03 (s, 2H) ; 7.07 (s, 1H)
 7.96 (d, 2H) ; 8.89 (d, 2H) ; 11.8 (s br 1H).

Example 4.4

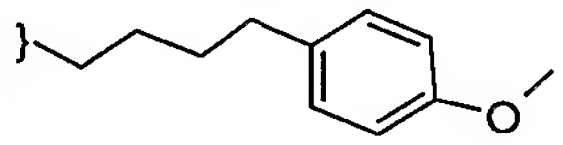
R	CR4 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS- ESI
	514 ; 0.19	3	0.165 ; 2	75 ; 68%	557 [M+H] +

Chromato. - EtOAc

15 ¹H NMR spectrum (DMSO d₆) : 1.12 (d, 3H) ; 1.25 (s, 6H) ; 1.32 (m, 2H) ; 1.42 (m, 4H) ;
 1.50 ; (m,2H) ; 1.61 (m, 4H) ; 2.28 (s, 6H) ; 2.35-2.85 (m, 7H) ; 4.14 (s, 2H) ; 4.57 (s, 2H) ;
 7.01 (s, 1H) ; 7.06 (s, 2H) ; 7.15 (m, 3H) ; 7.24 (m, 2H) ; 11.8 (s br 1H).

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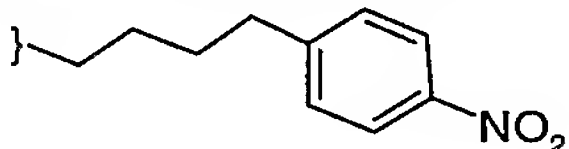
Example 4.5

R	CR5 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS- ESI
	1600; 0.5	30	0.58; 7	185 ; 63%	587 [M+H]]+

Chromato. - MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (DMSO d₆) : 1.13 (d, 3H) ; 1.25 (s, 6H) ; 1.35 (m, 2H) ; 1.44(m, 4H) ; 1.47 ; (m, 2H) ; 1.61 (m, 4H) ; 2.29 (s, 6H) ; 2.4-2.9 (m, 7H) ; 3.70 (s, 3H) ; 4.15 (s, 2H) ; 4.57 (s, 2H) ; 6.81 (d, 2H) ; 7.04 (m, 5H) ; 11.8 (s br 1H).

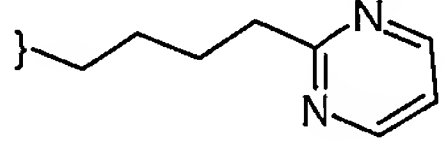
Example 4.6

R	CR6 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS- ESI
	230 ; 0.23	5	0.19 ; 2.3	103 ; 56%	xxx [M+H] +

Chromato. - EtOAc/CH₂Cl₂ (75 to 100% EtOAc) and then MeOH/CH₂Cl₂ (0 to 10% MeOH).

¹H NMR spectrum (DMSO d₆) : 1.14 (d, 3H) ; 1.25 (s, 6H) ; 1.37 (m, 2H) ; 1.42 (m, 4H) ; 1.54 (m, 2H) ; 1.59 (m, 4H) ; 2.28 (s, 6H) ; 2.55-2.95 (m, 7H) ; 4.15 (s, 2H) ; 4.57 (s, 2H) ; 7.02 (s, 1H) ; 7.05 (s, 2H) ; 7.44 (d, 2H) ; 8.14 (d, 2H) ; 11.8 (s br 1H)..

Example 4.7

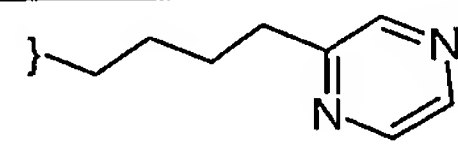
R	CR7 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.23	5	0.19 ; 2.3	48 ; 37%	559 [M+H] ⁺

Chromato. - MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (DMSO d₆) : 1.17 (d, 3H) ; 1.25 (s, 6H) ; 1.42 (m, 4H) ; 1.48 (m, 2H) ; 1.61 (m, 4H) ; 1.71 (m, 2H) ; 2.3 (s, 6H) ; 2.55-3.0 (m, 7H) ; 4.17 (s, 2H) ; 4.58 (s, 2H) ; 7.04 (m, 3H) ; 7.32 (t, 1H) ; 8.71 (d, 2H) ; 11.8 (s br 1H).

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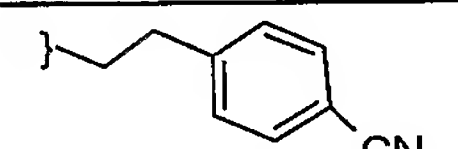
Example 4.8

R	CR8 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.23	3	0.19 ; 2.3	71 ; 54%	559 [M+H] ⁺

Chromato. - MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (DMSO d₆) : 1.14 (d, 3H) ; 1.25 (s, 6H) ; 1.42 (m, 6H) ; 1.63 (m, 6H) ;
2.29 (s, 6H) ; 2.55-2.9 (m, 7H) ; 4.16 (s, 2H) ; 4.57 (s, 2H) ; 7.02 (s, 1H) ; 7.05 (s, 2H) ; 8.45
5 (d, 1H) ; 8.52 (m, 2H) ; 11.8 (s br 1H)..

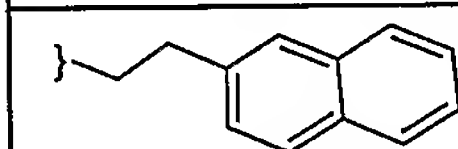
Example 4.9

R	CR9 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.38	10	0.31 ; 3.8	94 ; 45%	554 [M+H] ⁺

Chromato. - MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (DMSO d₆) : 1.12 (d, 3H) ; 1.24 (s, 6H) ; 1.41 (m, 4H) ; 1.60 (m, 4H) ;
10 2.29 (s, 6H) ; 2.6-2.9 (m, 7H) ; 4.15 (s, 2H) ; 4.56 (s, 2H) ; 7.02 (s, 3H) ; 7.31 (d, 2H) ; 7.68
(d, 2H) ; 11.8 (s br 1H).

Example 4.10

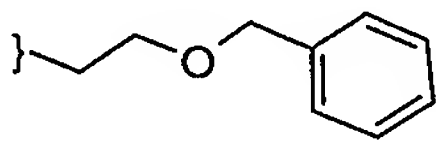
R	CR10 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.23	3	0.19 ; 2.3	50 ; 38%	579 [M+H] ⁺

Chromato. - MeOH/CH₂Cl₂ (0 to 7% MeOH)

15 ¹H NMR spectrum (DMSO d₆) : 1.16 (d, 3H) ; 1.25 (s, 6H) ; 1.40 (m, 4H) ; 1.59 (m, 4H) ;
2.27 (s, 6H) ; 2.55-2.95 (m, 7H) ; 4.16 (m, 2H) ; 4.56 (s, 2H) ; 7.03 (s, 1H) ; 7.04 (s, 2H) ; 7.3
(d, 1H) ; 7.46 (m, 2H) ; 7.62 (s, 1H) ; 7.8 (m, 2H) ; 7.86 (d, 1H) ; 11.8 (s br 1H).

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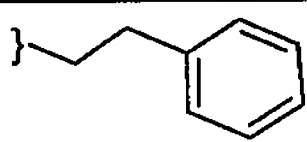
Example 4.11

R	CR11 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.23	3	0.19 ; 2.3	88 ; 68%	559 [M+H] ⁺

Chromato. - MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (DMSO d₆) : 1.14 (d, 3H) ; 1.25 (s, 6H) ; 1.42 (m, 4H) ; 1.61 (m, 4H) ;
2.29 (s, 6H) ; 2.6-2.95 (m, 5H) ; 3.45 (s, 2H) ; 4.16 (s, 2H) ; 4.41 (s, 2H) ; 4.56 (s, 2H) ; 7.03
5 (s, 1H) ; 7.06 (s, 2H) ; 7.2-7.35 (m, 5H) ; 11.8 (s br 1H).

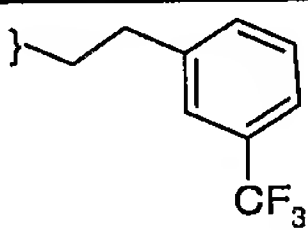
Example 4.12

R	CR12 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.46	10	0.38 ; 4.6	152 ; 62%	529 [M+H] ⁺

Chromato. - MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (DMSO d₆) : 1.14 (d, 3H) ; 1.25 (s, 6H) ; 1.42 (m, 4H) ; 1.60 (m, 4H) ;
10 2.29 (s, 6H) ; 2.45-2.95 (m, 7H) ; 4.15 (s, 2H) ; 4.57 (s, 2H) ; 7.03 (s, 1H) ; 7.04 (s, 2H), 7.10
(d, 2H) ; 7.16 (t, 1H) ; 7.24 (t, 2H) ; 11.8 (s br 1H).

Example 4.13

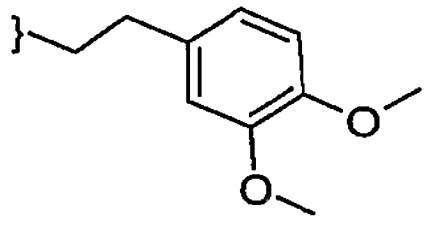
R	CR13 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.38	20	450 ; 7.6	154 ; 68%	597[M ⁺ H] ⁺

Chromato. - MeOH/CH₂Cl₂ (0 to 7% MeOH)

15 ¹H NMR spectrum (DMSO d₆) : 1.12 (d, 3H) ; 1.25 (s, 6H) ; 1.41 (m, 4H) ; 1.6 (m, 4H) ;
2.27 (s, 6H) ; 2.6-2.9 (m, 7H) ; 4.14 (m, 2H) ; 4.56 (s, 2H) ; 7.02 (s, 1H) ; 7.03 (s, 2H) ; 7.45
(m, 4H) ; 11.8 (s br 1H).

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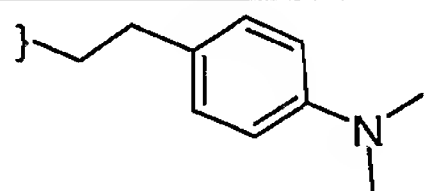
Example 4.14

R	CR14 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.25	5	0.27 ; 4.5	105 ; 71%	589 [M+H] ⁺

Chromato. - EtOAc/CH₂Cl₂ (50 to 100% EtOAc) and then MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (DMSO d₆) : 1.13 (d, 3H) ; 1.25 (s, 6H) ; 1.41 (m, 4H) ; 1.60 (m, 4H) ;
2.29 (s, 6H) ; 2.6-2.9 (m, 7H) ; 3.68 (s, 3H) ; 3.70 (s, 3H) ; 4.15 (s, 2H) ; 4.57 (s, 2H) ; 6.60
5 (q, 1H) ; 6.72 (d, 1H) ; 6.79 (d, 1H) ; 7.03 (s, 1H) ; 7.05 (s, 1H) ; 11.8 (s br 1H).

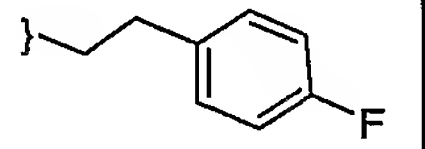
Example 4.15

R	CR15 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.25	5	0.295 ; 5	32 ; 22%	572 [M+H] ⁺

Chromato. - MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (DMSO d₆) : 1.16 (d, 3H) ; 1.25 (s, 6H) ; 1.42 (m, 4H) ; 1.60 (m, 4H) ;
10 2.30 (s, 6H) ; 2.6-2.9 (m, 7H) ; 2.83 (s, 6H) ; 4.16 (s, 2H) ; 4.57 (s, 2H) ; 6.61 (d, 2H) ; 6.92
(d, 2H) ; 7.04 (s, 3H) ; 11.8 (s br 1H).

Example 4.16

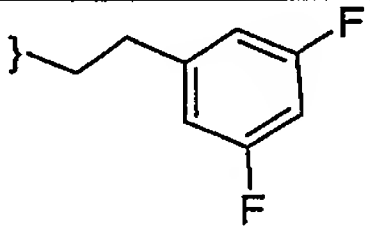
R	CR16 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.46	10	0.380 ; 4.6	149 ; 59%	547 [M+H] ⁺

Chromato. - EtOAc/CH₂Cl₂ (0 to 100% EtOAc) and then MeOH/CH₂Cl₂ (0 to 10% MeOH)

15 ¹H NMR spectrum (DMSO d₆) : 1.13 (d, 3H) ; 1.25 (s, 6H) ; 1.41 (m, 4H) ; 1.60 (m, 4H) ;
2.29 (s, 6H) ; 2.55-2.95 (m, 7H) ; 4.15 (s, 2H) ; 4.57 (s, 2H) ; 7.03 (m, 5H) ; 7.12 (m, 2H) ;
11.8 (s br 1H).

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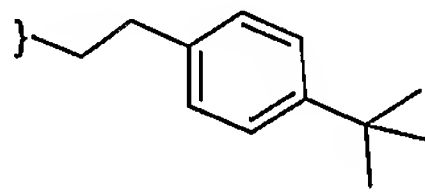
Example 4.17

R	CR18 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.25	5	0.27 ; 4.5	61 ; 43%	565 [M+H] ⁺

Chromato. - EtOAc/CH₂Cl₂ (50 to 100% EtOAc) and then MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (CDCl₃) : 1.21 (d, 3H) ; 1.35 (d, 6H) ; 1.44 (m, 4H) ; 1.75 (m, 4H) ; 2.33 (s, 6H) ; 2.6-3.1 (m, 7H) ; 4.26 (m, 2H) ; 4.63 (s, 2H) ; 6.61 (m, 3H) ; 7.01 (s, 3H) ; 9.1 (s br, 5 1H).

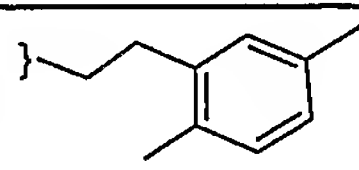
Example 4.18

R	CR19 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.25	5	0.27 ; 4.5	53 ; 36%	585 [M+H] ⁺

Chromato. - MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (DMSO d₆) : 1.14 (d, 3H) ; 1.25 (s, 15H) ; 1.41 (m, 4H) ; 1.6 (m, 4H) ; 2.29 (s, 6H) ; 2.55-2.95 (m, 7H) ; 4.15 (s, 2H) ; 4.56 (s, 2H) ; 7.02 (d, 2H) ; 7.03 (s, 1H) ; 7.04 (s, 2H) ; 7.25 (d, 2H) ; 11.8 (s br 1H).

Example 4.19

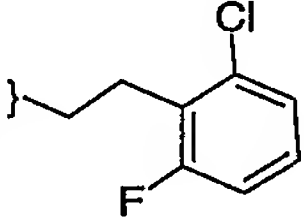
R	CR20 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.25	5	0.27 ; 4.5	40 ; 29%	557 [M+H] ⁺

Chromato. - MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (DMSO d₆) : 1.18 (d, 3H) ; 1.25 (s, 6H) ; 1.42 (m, 4H) ; 1.6 (m, 4H) ; 2.16 (s, 3H) ; 2.20 (s, 3H) ; 2.30 (s, 6H) ; 2.5-2.95 (m, 7H) ; 4.17 (s, 2H) ; 4.56 (s, 2H) ; 6.84 (s, 1H) ; 6.88 (d, 1H) ; 6.99 (s, 1H) ; 7.05 (s, 3H) ; 11.8 (s br 1H).

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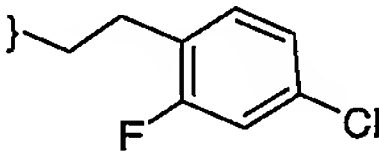
Example 4.20

R	CR21 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.25	5	0.27 ; 4.5	49 ; 34%	581 [M+H] ⁺

Chromato. - MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (DMSO d₆) : 1.13 (d, 3H) ; 1.25 (s, 6H) ; 1.42 (m, 4H) ; 1.61 (m, 4H) ; 2.29 (s, 6H) ; 2.55-2.9 (m, 7H) ; 4.15 (s, 2H) ; 4.57 (s, 2H) ; 7.02 (s, 1H) ; 7.04 (s, 2H) ; 7.15 (m, 1H) ; 7.27 (m, 2H) ; 11.8 (s br 1H).

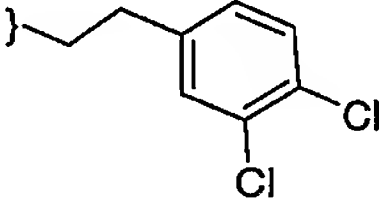
Example 4.21

R	CR22 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.25	5	0.27 ; 4.5	64 ; 44%	581 [M+H] ⁺

Chromato. - MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (DMSO d₆) : 1.13 (d, 3H) ; 1.25 (s, 6H) ; 1.42 (m, 4H) ; 1.6 (m, 4H) ; 2.29 (s, 6H) ; 2.55-2.95 (m, 7H) ; 4.15 (s, 2H) ; 4.56 (s, 2H) ; 7.02 (s, 1H) ; 7.04 (s, 2H) ; 7.10 (m, 1H) ; 7.26 (m, 1H) ; 7.35 (m, 1H) ; 11.8 (s br 1H).

Example 4.22

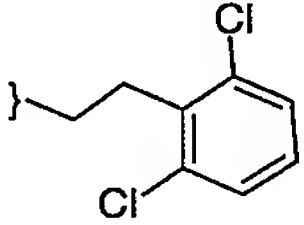
R	CR23 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.25	5	0.27 ; 4.5	50 ; 34%	597 [M+H] ⁺

Chromato. - MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (DMSO d₆) : 1.13 (d, 3H) ; 1.25 (s, 6H) ; 1.42 (m, 4H) ; 1.6 (m, 4H) ; 2.28 (s, 6H) ; 2.55-2.95 (m, 7H) ; 4.16 (m, 2H) ; 4.56 (s, 2H) ; 7.03 (s, 3H) ; 7.11 (d, 1H) ; 7.41 (s, 1H) ; 7.48 (d, 1H) ; 11.8 (s br 1H).

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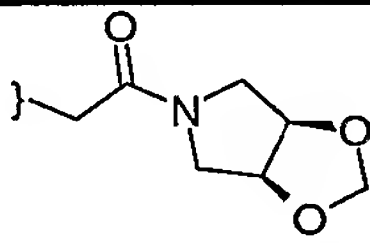
Example 4.23

R	CR24 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.25	5	0.27 ; 4.5	40 ; 27%	597 [M+H] ⁺

Chromato. - MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (DMSO d₆) : 1.14 (d, 3H) ; 1.25 (s, 6H) ; 1.41 (m, 4H) ; 1.61 (m, 4H) ;
2.29 (s, 6H) ; 2.55-2.95 (m, 7H) ; 4.15 (s, 2H) ; 4.57 (s, 2H) ; 7.02 (s, 1H) ; 7.05 (s, 2H) ; 7.25
5 (t, 1H) ; 7.4 (d, 2H) ; 11.8 (s br 1H).

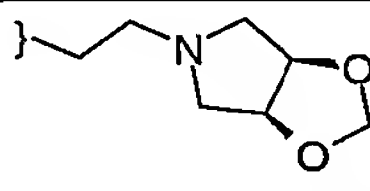
Example 4.24

R	CR25 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.23	5	540 ; 9.2	50 ; 37%	580 [M+H] ⁺

Chromato. - MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (DMSO d₆) : 1.13 (d, 3H) ; 1.25 (s, 6H) ; 1.42 (m, 4H) ; 1.61 (m, 4H) ;
10 2.31 (s, 6H) ; 2.55-2.95 (m, 3H) ; 3.1-3.75 (m, 4H) ; 3.67 (m, 2H) ; 4.15 (s, 2H) ; 4.57 (s, 2H)
; 4.62 (m, 1H) ; 4.68 (m, 1H) ; 4.76 (s, 1H) ; 4.93 (s, 1H) ; 7.03 (s, 1H) ; 7.06 (s, 2H) ; 11.8 (s
br 1H).

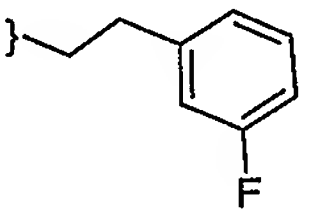
Example 4.25

R	CR26 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.23	5	0.810 ; 13.2	68 ; 52%	566 [M+H] ⁺

15 Chromato. - MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (DMSO d₆) : 1.13 (d, 3H) ; 1.26 (s, 6H) ; 1.42 (m, 4H) ; 1.62 (m, 4H) ;
2.03 (m, 2H) ; 2.31 (s, 6H) ; 2.33 (m, 3H) ; 2.55-2.95 (m, 6H) ; 4.14 (s, 2H) ; 4.49 (m, 2) ;
4.58 (s, 2H) ; 4.71 (s, 1H) ; 4.8 (s, 1H) ; 7.03 (s, 1H) ; 7.06 (s, 2H) ; 11.8 (s br 1H).

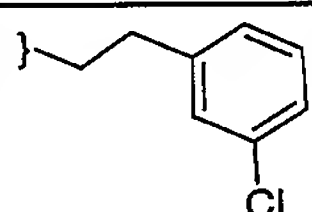
Example 4.26

R	CR27 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.26	5	0.27 ; 3.3	55 ; 38%	547 [M+H] ⁺

Chromato. - MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (DMSO d₆) : 1.14 (d, 3H) ; 1.25 (s, 6H) ; 1.42 (m, 4H) ; 1.6 (m, 4H) ; 2.29 (s, 6H) ; 2.55-2.95 (m, 7H) ; 4.15 (s, 2H) ; 4.57 (s, 2H) ; 6.97 (m, 3H) ; 7.03 (s, 3H) ; 7.27 (m, 5 1H) ; 11.8 (s br 1H).

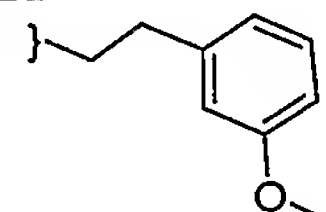
Example 4.27

R	CR28 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.26	5	0.27 ; 3.3	40 ; 27%	563 [M+H] ⁺

Chromato. - MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (DMSO d₆) : 1.14 (d, 3H) ; 1.25 (s, 6H) ; 1.42 (m, 4H) ; 1.6 (m, 4H) ; 2.29 (s, 6H) ; 2.55-2.95 (m, 7H) ; 4.15 (m, 2H) ; 4.57 (s, 2H) ; 7.03 (s, 3H) ; 7.09 (m, 1H) ; 7.25 (m, 3H) ; 11.8 (s br 1H).

Example 4.28

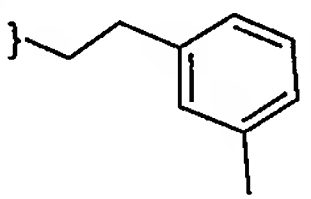
R	CR29 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.26	5	0.27 ; 3.3	47 ; 32%	559 [M+H] ⁺

Chromato. - MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (DMSO d₆) : 1.16 (d, 3H) ; 1.25 (s, 6H) ; 1.42 (m, 4H) ; 1.6 (m, 4H) ; 2.3 (s, 6H) ; 2.55-2.95 (m, 7H) ; 3.71 (s, 3H) ; 4.16 (s, 2H) ; 4.56 (s, 2H) ; 6.7 (m, 3H) ; 7.04 (s, 3H) ; 7.16 (m, 1H) ; 11.8 (s br 1H).

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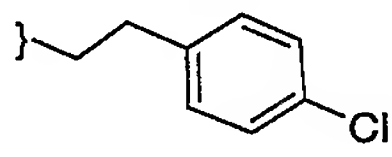
Example 4.29

R	CR30 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.26	5	0.27 ; 3.3	70 ; 49%	543 [M+H] ⁺

Chromato. - MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (DMSO d₆) : 1.14 (d, 3H) ; 1.25 (s, 6H) ; 1.42 (m, 4H) ; 1.6 (m, 4H) ; 2.24 (s, 3H) ; 2.3 (s, 6H) ; 2.55-2.95 (m, 7H) ; 4.16 (s, 2H) ; 4.57 (s, 2H) ; 6.90 (m, 2H) ; 6.98 (d, 5 1H) ; 7.04 (s, 3H) ; 7.12 (t, 1H) ; 11.8 (s br 1H).

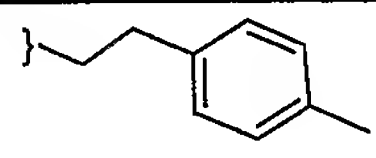
Example 4.30

R	CR31 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.26	5	0.27 ; 3.3	64 ; 43%	563 [M+H] ⁺

Chromato. - MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (DMSO d₆) : 1.14 (d, 3H) ; 1.25 (m, 6H) ; 1.42 (m, 4H) ; 1.6 (m, 4H) ;
10 2.29 (s, 6H) ; 2.5-2.9 (m, 7H) ; 4.16 (s, 2H) ; 4.56 (m, 2H) ; 7.03 (s, 3H) ; 7.14 (d, 2H) ; 7.29 (d, 2H) ; 11.8 (s br 1H).

Example 4.31

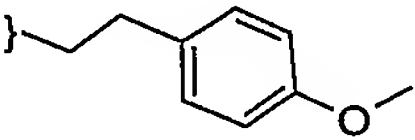
R	CR32 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.26	5	0.27 ; 3.3	143 ; 100%	543 [M+H] ⁺

Chromato. - MeOH/CH₂Cl₂ (0 to 10% MeOH)

15 ¹H NMR spectrum (DMSO d₆) : 1.14 (d, 3H) ; 1.25 (m, 6H) ; 1.42 (m, 4H) ; 1.6 (m, 4H) ;
2.24 (s, 3H) ; 2.29 (s, 6H) ; 2.5-2.95 (m, 7H) ; 4.15 (s, 2H) ; 4.56 (m, 2H) ; 6.98 (d, 2H) ; 7.04 (m, 5H) ; 11.8 (s br 1H).

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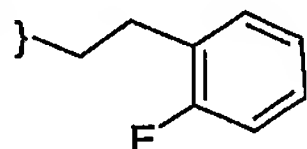
Example 4.32

R	CR33 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.26	5	0.27 ; 3.3	133 ; 90%	559 [M+H] ⁺

Chromato. - MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (DMSO d₆) : 1.13 (d, 3H) ; 1.25 (m, 6H) ; 1.42 (m, 4H) ; 1.6 (m, 4H) ;
2.29 (s, 6H) ; 2.5-2.95 (m, 7H) ; 3.70 (s, 3H) ; 4.15 (s, 2H) ; 4.56 (m, 2H) ; 6.79 (d, 2H) ; 7.01
5 ; (d, 2H) ; 7.04 (s, 3H) ; 11.8 (s br 1H).

Example 4.33

R	CR34 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.26	5	0.27 ; 3.3	51 ; 35%	547 [M+H] ⁺

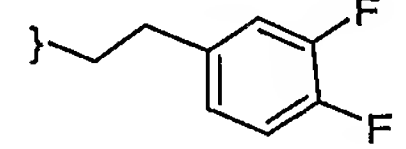
Chromato. - MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (DMSO d₆) : 1.14 (d, 3H) ; 1.25 (m, 6H) ; 1.42 (m, 4H) ; 1.6 (m, 4H) ;
10 2.29 (s, 6H) ; 2.5-2.95 (m, 7H) ; 3.70 (s, 3H) ; 4.16 (m, 2H) ; 4.56 (s, 2H) ; 7.04 (s, 3H) ; 7.09
(m, 2H) ; 7.21 ; (m, 2H) ; 11.8 (s br 1H).

Example 4.34

Example **4.34** was prepared by a different methodology (opening of epoxide by **Ce**) : see
15 below.

Example 4.35

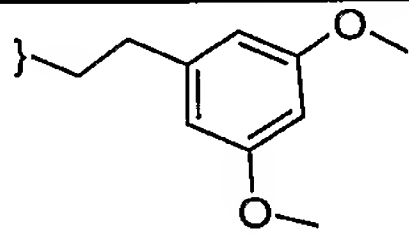
R	CR36 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.25	5	0.27 ; 4.5	78 ; 55%	565 [M+H] ⁺

Chromato. - EtOAc/CH₂Cl₂ (50 to 100% EtOAc) and then MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (DMSO d₆) : 1.13 (d, 3H) ; 1.25 (s, 6H) ; 1.42 (m, 4H) ; 1.61 (m, 4H) ;
20 2.29 (s, 6H) ; 2.55-2.95 (m, 7H) ; 4.14 (m, 2H) ; 4.57 (s, 2H) ; 6.94 (m, 1H) ; 7.03 (s, 3H) ;
7.15 (m, 1H) ; 7.26 (m, 1H) ; 11.8 (s br 1H).

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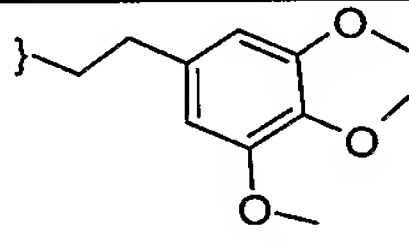
Example 4.36

R	CR37 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.25	5	0.27 ; 4.5	32 ; 22%	589 [M+H] ⁺

Chromato. - EtOAc/CH₂Cl₂ (50 to 100% EtOAc) and then MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (DMSO d₆) : 1.14 (d, 3H) ; 1.25 (s, 6H) ; 1.41 (m, 4H) ; 1.60 (m, 4H) ;
 5 2.29 (s, 6H) ; 2.55-2.95 (m, 7H) ; 3.68 (s, 6H) ; 4.15 (m, 2H) ; 4.57 (s, 2H) ; 6.3 (m, 3H) ;
 7.03 (s, 1H) ; 7.04 (s, 2H) ; 11.8 (s br 1H).

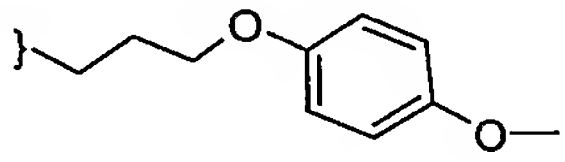
Example 4.37

R	CR38 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.25	5	0.27 ; 4.5	102 ; 66%	619 [M+H] ⁺

Chromato. - EtOAc/CH₂Cl₂ (50 to 100% EtOAc) and then MeOH/CH₂Cl₂ (0 to 10% MeOH)

10 ¹H NMR spectrum (DMSO d₆) : 1.14 (d, 3H) ; 1.25 (s, 6H) ; 1.41 (m, 4H) ; 1.60 (m, 4H) ;
 2.29 (s, 6H) ; 2.55-2.95 (m, 7H) ; 3.60 (s, 3H) ; 3.69 (s, 6H) ; 4.14 (s, 2H) ; 4.56 (s, 2H) ; 6.42
 (s, 2H) ; 7.02 (s, 1H) ; 7.05 (s, 2H) ; 11.8 (s br 1H) .

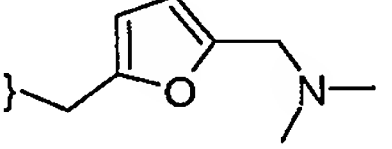
Example 4.38

R	CR39 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.25	5	0.27 ; 4.5	91 ; 62%	589 [M ⁺ H] ⁺

15 Chromato. - EtOAc/CH₂Cl₂ (50 to 100% EtOAc) and then MeOH/CH₂Cl₂ (0 to 10%
 MeOH)

¹H NMR spectrum (DMSO d₆) : 1.15 (d, 3H) ; 1.25 (s, 6H) ; 1.42 (m, 4H) ; 1.61 (m, 4H) ;
 1.78 (m, 2H) ; 2.29 (s, 6H) ; 2.55-2.95 (m, 5H) ; 3.68 (s, 3H) ; 3.88 (t, 2H) ; 4.15 (s, 2H) ; 4.56
 (s, 2H) ; 6.80 (m, 4H) ; 7.02 (s, 1H) ; 7.06 (s, 2H) ; 11.8 (s br 1H).

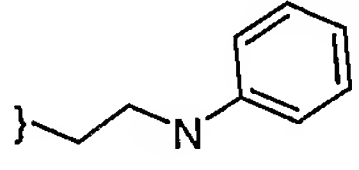
Example 4.39

R	CR40 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.25	5	0.27 ; 4.5	85 ; 61%	562 [M+H] ⁺

Chromato. - EtOAc/CH₂Cl₂ (50 to 100% EtOAc) and then MeOH/CH₂Cl₂ (0 to 10% MeOH).

¹H NMR spectrum (DMSO d₆) : 1.13 (d, 3H) ; 1.25 (s, 6H) ; 1.42 (m, 4H) ; 1.61 (m, 4H) ;
2.08 (s, 6H) ; 2.30 (s, 6H) ; 2.55-2.95 (m, 3H) ; 3.35 (s, 2H) ; 3.53 (s, 2H) ; 4.14 (m, 2H) ;
5 4.57 (s, 2H) ; 6.01 (d, 1H) ; 6.10 (d, 1H) ; 7.03 (s, 1H) ; 7.05 (s, 2H) , 11.8 (s br 1H).

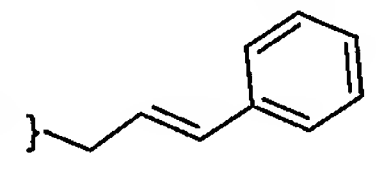
Example 4.40

R	CR41 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.25	5	0.27 ; 4.5	40 ; 29%	544 [M+H] ⁺

Chromato. - EtOAc/CH₂Cl₂ (50 to 100% EtOAc) and then MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (DMSO d₆) : 1.14 (d, 3H) ; 1.25 (s, 6H) ; 1.41 (m, 4H) ; 1.61 (m, 4H) ;
10 2.29 (s, 6H) ; 2.55-2.95 (m, 5H) ; 3.01 ; (m, 2H) ; 4.14 (s, 2H) ; 4.56 (s, 2H) ; 5.37 (s, 1H) ;
6.50 (m, 3H) ; 7.04 (m, 5H) ; 11.8 (s br 1H).

Example 4.41

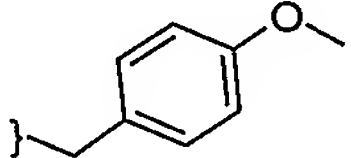
R	CR42 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.25	5	0.27 ; 4.5	87 ; 64%	541 [M+H] ⁺

Chromato. - EtOAc/CH₂Cl₂ (50 to 100% EtOAc) and then MeOH/CH₂Cl₂ (0 to 10% MeOH)

15 ¹H NMR spectrum (DMSO d₆) : 1.16 (d, 3H) ; 1.20 (m, 6H) ; 1.41 (m, 4H) ; 1.61 (m, 4H) ;
2.30 (s, 6H) ; 2.55-2.95 (m, 3H) ; 3.27 (m, 2) ; 4.13 (s, 2H) ; 4.53 (s, 2H) ; 6.23 (m, 1H) ; 6.42
(d, 1H) ; 7.04 (s, 1H) ; 7.07 (s, 2H) ; 7.21 (t, 1H) ; 7.30 (t, 2H) ; 7.35 (d, 2H) ; 11.8 (s br 1H).

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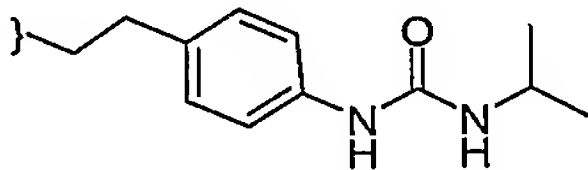
Example 4.42

R	CR43 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.25	5	0.27 ; 4.5	98 ; 72%	545 [M+H] ⁺

Chromato. - EtOAc/CH₂Cl₂ (50 to 100% EtOAc) and then MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (DMSO d₆) : 1.14 (d, 3H) ; 1.20 (m, 6H) ; 1.42 (m, 4H) ; 1.61 (m, 4H) ; 2.31 (s, 6H) ; 2.61 (m, 1H) ; 2.68 (m, 1H) ; 2.85 (m, 1H) ; 3.53 (s, 2H) ; 3.70 (s, 3H) ; 4.12 (m, 2H) ; 4.56 (s, 2H) ; 6.81 (d, 2H) ; 7.03 (s, 1H) ; 7.07 (s, 2H) ; 7.12 (d, 2H) ; 11.8 (s br 1H).

Example 4.43

R	CR44 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.25	5	0.27 ; 3.3	100 ; 63%	629 [M+H] ⁺

Chromato. - EtOAc/CH₂Cl₂ (0 to 100% EtOAc) and then MeOH/CH₂Cl₂ (0 to 10% MeOH)

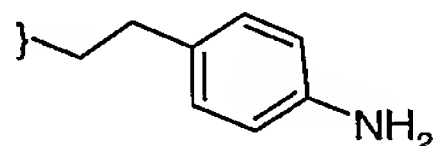
10

¹H NMR spectrum (DMSO d₆) : 1.08 (d, 6H) ; 1.18 (d, 3H) ; 1.26 (s, 6H) ; 1.42 (m, 4H) ; 1.60 (m, 4H) ; 2.31 (s, 6H) ; 2.55-2.95 (m, 7H) ; 3.73 (m, 1H) ; 4.18 (m, 2H) ; 4.56 (s, 2H) ; 5.95 (s, 1H) ; 6.96 (d, 2H) ; 7.04 (s, 3H) ; 7.25 (d, 2H) ; 8.22 (s, 1H) ; 11.8 (s br 1H).

15 **Example 4.44**

Example **C45** was prepared by a different methodology (reductive amination of Ce) : see below.

Example 4.45

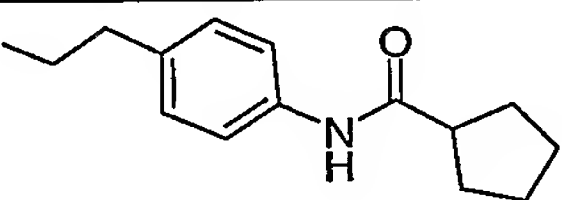
R	CR46 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	108 ; 0.14	3	0.17 ; 2.0	71 ; 93%	544 [M+H] ⁺

20 Chromato. - EtOAc and then MeOH/CH₂Cl₂ (0 to 15% MeOH)

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^1H NMR spectrum (DMSO d_6) : 1.14 (d, 3H) ; 1.25 (s, 6H) ; 1.42 (m, 4H) ; 1.61 (m, 4H) ; 2.3 (s, 6H) ; 2.55-2.95 (m, 7H) ; 4.14 (s, 2H) ; 4.57 (s, 2H) ; 4.83 (s, 2H) ; 6.44 (d, 2H) ; 6.74 (d, 2H) ; 7.04 (s, 1H) ; 7.05 (s, 2H) ; 11.8 (s br, 1H).

5 **Example 4.46**

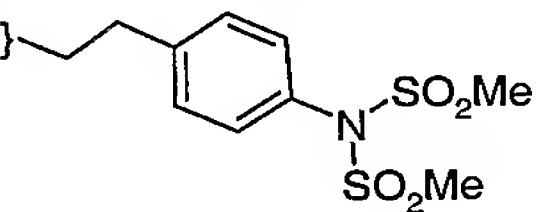
R	CR47 mg ; mmol	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS- ESI
	nd* ; 0.14	5	0.15 ; 1.8	41 ; 45%	640 [M+H] ⁺

Chromato. - EtOAc/CH₂Cl₂ (0 to 100% EtOAc) and then MeOH/CH₂Cl₂ (0 to 10% MeOH)

^1H NMR spectrum (DMSO d_6) : 1.18 (d, 3H) ; 1.25 (m, 6H) ; 1.42 (m, 4H) ; 1.5-1.9 (m, 12H) ; 2.31 (s, 6H) ; 2.55-2.95 (m, 8H) ; 4.16 (m, 2H) ; 4.56 (s, 2H) ; 7.03 (m, 5H) ; 7.51 (d, 2H) ; 9.81 ; (s, 1H) ; 11.8 (s br, 1H).

10

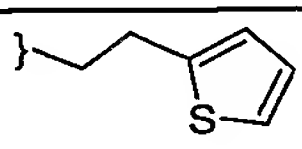
Example 4.47

R	CR48 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS- ESI
	nd* ; 0.15	3	0.12 ; 1.5	135 ; 99%	700 [M+H] ⁺

Chromato. - EtOAc/CH₂Cl₂ (0 to 100% EtOAc)

^1H NMR spectrum (DMSO d_6 - TFAd) : 1.28 (m, 9H) ; 1.43 (m, 4H) ; 1.62 (m, 4H) ; 2.33 (s, 6H) ; 2.8-3.25 (m, 7H) ; 3.51 (s, 6H) ; 4.23 (m, 2H) ; 4.57 (s, 2H) ; 7.05 (s, 2H) ; 7.08 (s, 1H) ;
15 7.31 (d, 2H) ; 7.47 (d, 2H) ; 11.8 (s br, 1H).

Example 4.48

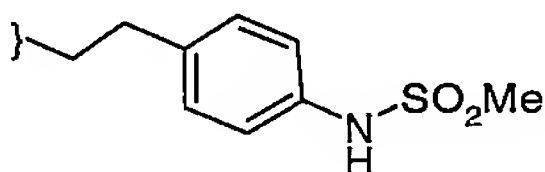
R	CR49 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.25	3	0.15 ; 2.5	80 ; 60%	535 [M+H] ⁺

Chromato. - EtOAc/CH₂Cl₂ (0 to 100% EtOAc) and then MeOH/CH₂Cl₂ (0 to 10% MeOH)

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¹H NMR spectrum (DMSO d₆) : 1.13 (d, 3H) ; 1.25 (s, 6H) ; 1.42 (m, 4H) ; 1.61 (m, 4H) ; 2.30 (s, 6H) ; 2.55-2.95 (m, 7H) ; 4.15 (m, 2H) ; 4.57 (s, 2H) ; 6.76 (d, 1H) ; 6.90 (dd, 1H) ; 7.02 (s, 1H) ; 7.05 (s, 2H) ; 7.27 (d, 1H) ; 11.76 (s br, 1H).

5 **Example 4.49**

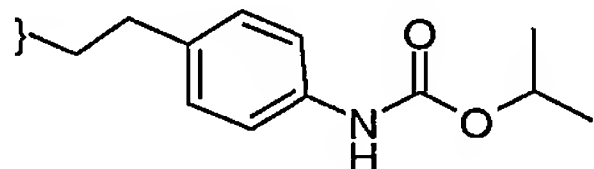
R	CR50 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS- ESI
	nd* ; 0.6	5	0.355 ; 6	181 ; 49%	622 [M+H] ⁺

Chromato. - MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (DMSO d₆) : 1.12 (d, 3H) ; 1.25 (s, 6H) ; 1.41 (m, 4H) ; 1.60 (m, 4H) ; 2.29 (s, 6H) ; 2.55-2.85 (m, 7H) ; 2.92 (s, 3H) ; 4.14 (s, 2H) ; 4.57 (s, 2H) ; 7.06 (m, 7H) ; 11.74 (s br, 1H).

10

Example 4.50

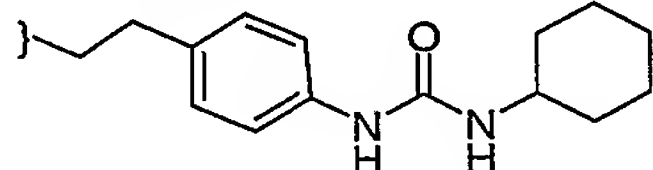
R	CR51 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS- ESI
	nd* ; 0.15	3	0.09 ; 1.5	63 ; 67%	630 [M+H] ⁺

Chromato. - MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (DMSO d₆) : 1.16 (d, 3H) ; 1.25 (m, 12H) ; 1.42 (m, 4H) ; 1.60 (m, 4H) ; 2.30 (s, 6H) ; 2.55-2.95 (m, 7H) ; 4.16 (m, 2H) ; 4.5 (s, 2H) ; 4.87 ; (m, 1H) ; 7.0 (d, 2H) ; 7.04 (s, 3H) ; 7.34 (s, 2H) ; 9.44 (s, 1H) ; 11.8 (s br, 1H).

15

Example 4.51

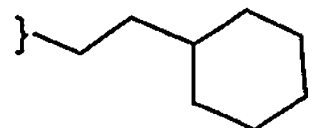
R	CR52 mg ; mmol Cf	CH ₂ Cl ₂ ml	Propylamine ml ; mmol	Mass mg; Yield	MS- ESI
	nd* ; 0.11	2	0.065 ; 1.1	42 ; 57%	669 [M+H] ⁺

Chromato. - MeOH/CH₂Cl₂ (0 to 15% MeOH)

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^1H NMR spectrum (DMSO d_6) : 1.16 (d, 3H) ; 1.25 (s, 6H) ; 1.25-1.8 (m, 18H) ; 2.31 (s, 6H) ; 2.55-2.95 (m, 7H) ; 3.43 (m, 1H) ; 4.16 (m, 2H) ; 4.56 (s, 2H) ; 6.04 (s, 1H) ; 6.96 (d, 2H) ; 7.04 (s, 3H) ; 7.25 (d, 2H) ; 8.25 (s, 1H) ; 11.86 (s br, 1H).

5 **Example 4.52**

R	CR53 mg ; mmol Cf	CH_2Cl_2 ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.4	5	0.24 ; 4	93 ; 44%	535 $[\text{M}+\text{H}]^+$

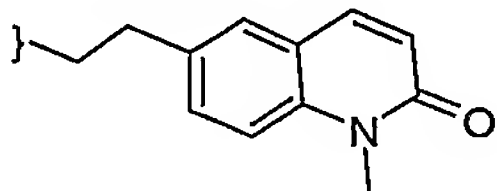
Chromato. – EtOAc

^1H NMR spectrum (DMSO d_6) : 1.13 (d, 3H) ; 1.25 (s, 6H) ; 1.1-1.7 (m, 21H) ; 2.3 (s, 6H) ; 2.35-2.85 (m, 5H) ; 4.15 (s, 2H) ; 4.57 (s, 2H) ; 7.03 (s, 1H) ; 7.06 (s, 2H) 11.8 (s br, 1H).

10 **Example 4.53**

Example **4.53** was prepared by a different methodology (alkylation of Ce) : see below

Example 4.54

R	CR55 mg ; mmol Cf	CH_2Cl_2 ml	Propylamine ml ; mmol	Mass mg; Yield	MS-ESI
	nd* ; 0.25	5	0.15 ; 2.5	64 ; 42%	610 $[\text{M}+\text{H}]^+$

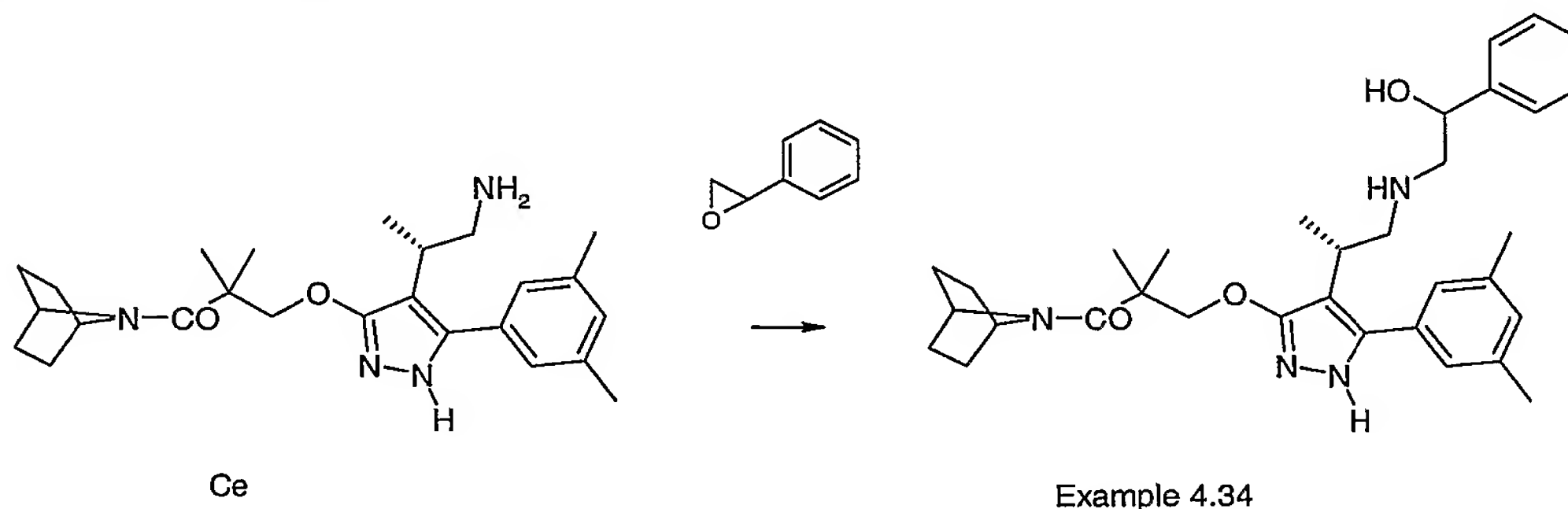
15 Chromato. - EtOAc and then MeOH/ CH_2Cl_2 (0 to 10% MeOH)

^1H NMR spectrum (DMSO d_6) : 1.16 (m, 3H) ; 1.25 (s, 6H) ; 1.41 (m, 4H) ; 1.59 (m, 4H) ; 2.28 (s, 6H) ; 2.55-3.0 (m, 7H) ; 3.60 (s, 3H) ; 4.16 (s, 2H) ; 4.56 (s, 2H) ; 6.6 (d, 1H) ; 7.02 (s, 3H) ; 7.42 (m, 3H) ; 7.81 (d, 1H) ; 11.8 (s br, 1H).

* nd = not determined, partially purified **CR** used directly from previous step.

Example 4.34

2-[3-(2,2-dimethyl-3-oxo-3-azabicyclo[2.2.1]heptan-7-ylpropoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-hydroxy-2-phenylethyl]-(2*S*)-propylamine



- 5 A solution of **Ce** (106 mg ; 0.25 mmol) in acetonitrile (3 ml) was treated with styrene oxide and the mixture was heated at 60°C overnight. The solvent was evaporated and the residue purified by flash chromatography eluting with increasingly polar mixtures of MeOH/CH₂Cl₂ hexanes (0 to 10% MeOH) to give **Example 4.34** as a white foam (40 mg).

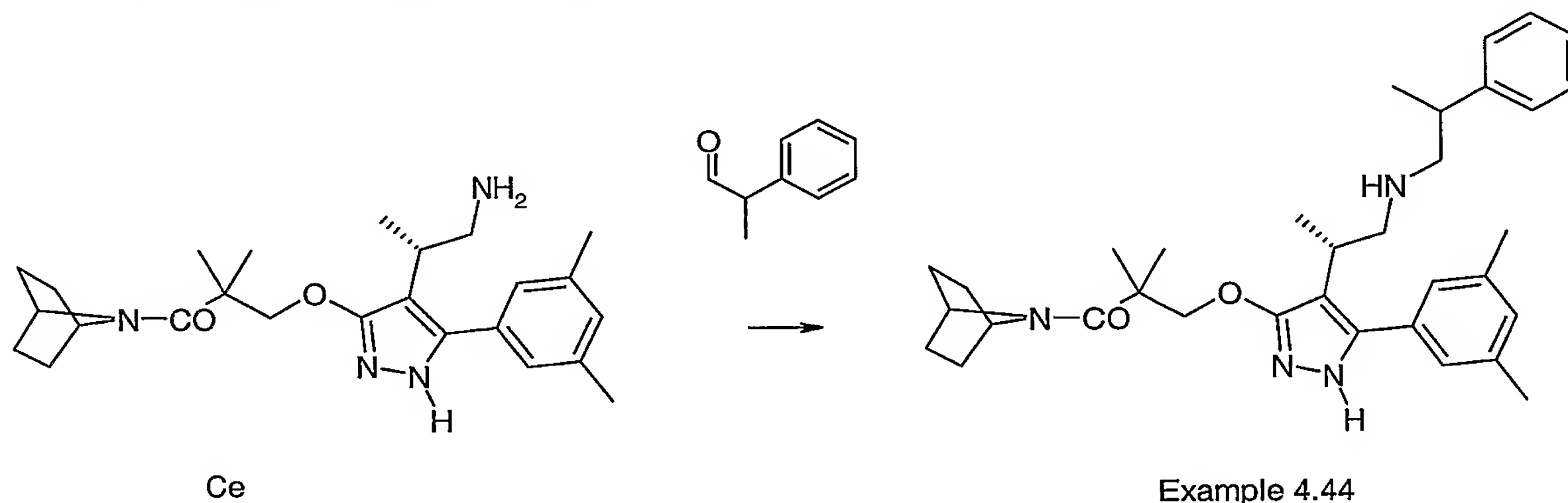
Yield : 30%.

- 10 ¹H NMR spectrum (DMSO d₆) : 1.15 (m, 3H) ; 1.26 (m, 6H) ; 1.42 (m, 4H) ; 1.61 ; (m, 4H) ; 2.29 (s, 6H) ; 2.55-2.95 (m, 5H) ; 4.16 (m, 2H) ; 4.57 (m, 3H) ; 7.06 (m, 3H) ; 7.26 (m, 5H) ; 11.6 (s br, 1H).

MS-ESI : 545 [M+H]⁺

Example 4.44

2-[3-(2,2-dimethyl-3-oxo-3-azabicyclo[2.2.1]heptan-7-ylpropoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-methyl-2-phenylethyl]-(2*S*)-propylamine



- 5 A solution of **Ce** (126 mg ; 0.3 mmol) and 2-phenyl propionaldehyde (45 μ l ; 0.3 mmol) in methanol (6 ml) under argon was cooled to 0°C. Sodium cyanoborohydride (39 mg ; 0.6 mmol) was added portionwise and the mixture was stirred for 3 h. The methanol was evaporated and the residue taken up in CH₂Cl₂. The organic phase was washed with sat. aq. NaHCO₃, brine and dried over MgSO₄. The residue was purified by flash chromatography
- 10 eluting with increasingly polar mixtures of EtOAc/CH₂Cl₂ (0 to 100% EtOAc) and then MeOH/CH₂Cl₂ (0 to 10% MeOH) to give **Example 4.44** as a white foam (88 mg).

Yield : 54%.

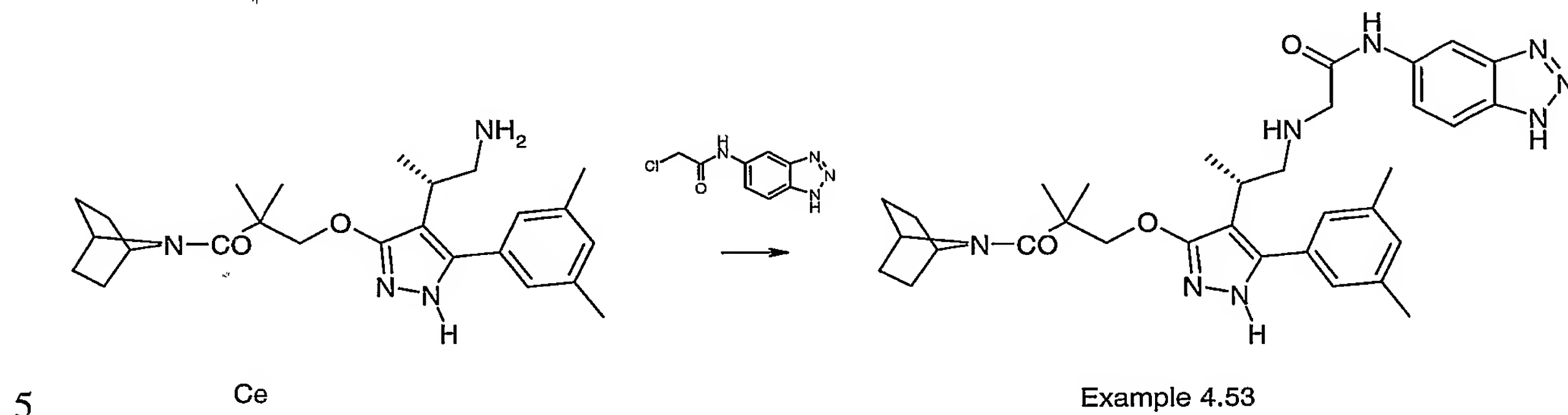
- ¹H NMR spectrum (DMSO d₆) : 1.10 (m, 6H) ; 1.24 (s, 6H) ; 1.41 (m, 4H) ; 1.60 (m, 4H) ; 2.28 (m, 6H) ; 2.55-2.95 (m, 6H) ; 4.14 (s, 2H) ; 4.56 (s, 2H) ; 7.03 (s, 3H) ; 7.09 (t, 2H) ;
- 15 7.16 (d, 1H) ; 7.23 (t, 2H) ; 11.8 (s br 1H).

MS-ESI : 543 [M+H]⁺

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Example 4.53

2-[3-(2,2-dimethyl-3-oxo-3-azabicyclo[2.2.1]heptan-7-ylpropoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[1*H*-1,2,3-benzotriazol-5-ylaminocarbonylmethyl]-(2*S*)-propylamine



To a solution of **Ce** (200 mg ; 0.47 mmol) in DMA (1 ml) at 140°C was added solid *N*-1*H*-1,2,3-benzotriazole-5-yl-2-chloroacetamide (98 mg ; 0.47 mmol) over 5 min. The reaction mixture was heated at 140°C for a further 5 min. The resulting orange solution was allowed to cool to room temperature and purified by flash chromatography on silica gel eluting with

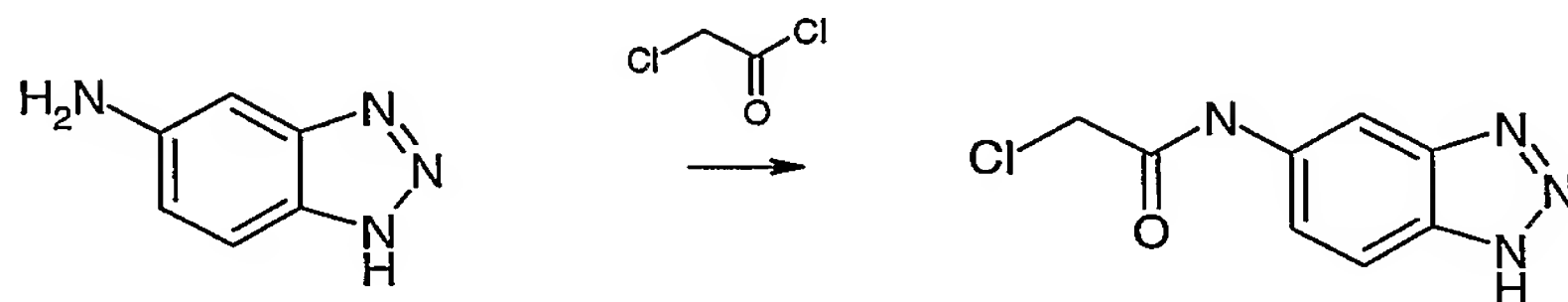
10 CH₂Cl₂/NH₃ in MeOH (0 to 5% NH₃ in MeOH) to give **Example 4.53** (110 mg).

Yield : 37%

¹H NMR spectrum (CDCl₃) : 1.20 (d, 3H) ; 1.22 (s, 6H) ; 1.40 (m, 4H) ; 1.70 (m, 4H) ; 2.31 (s, 6H) ; 2.77 (m, 1H) ; 2.99 (m, 2H) ; 3.34 (s, 2H), 4.28 (m, 2H) ; 4.57 (s, 2H) ; 5.37 (s, 1H) ; 6.95 (s, 2H) ; 7.02 (s, 1H) ; 7.17 (br d, 1H) ; 7.84 (br d, 1H) ; 8.26 (s, 1H) ; 9.50 (br s, 1H) ;

15 9.67 (s, 1H).

MS-ESI : 599 [M+H]⁺



To a stirred solution of 5-aminobenzotriazole (1.00 g ; 7.50 mmol) in THF (20 ml) at -10°C,

20 were added triethylamine (0.987 g ; 9.75 mmol) and chloroacetyl chloride (0.841 g ; 7.50

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mmol) dropwise over 5 min. The reaction mixture was allowed to warm to room temperature and stirred overnight.

The resulting precipitate was collected by filtration, washed with CH₂Cl₂ and dried to afford *N*-1*H*-1,2,3-benzotriazole-5-yl-2-chloroacetamide (1.32 g) as a beige solid.

5 Yield : 83.5%

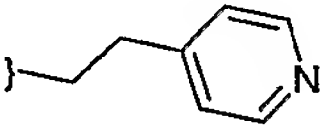
¹H NMR spectrum (DMSO d₆) : 4.33 (s, 2H) ; 7.42 (br d, 1H) ; 7.91 (br d, 1H) ; 8.35 (s, 1H) .

MS-ESI : 211 [M+H]⁺

Intermediates for Examples 4.1-4.55, CR1-CR55 respectively

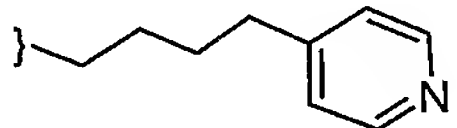
- 10 Starting materials **CR1-CR55** were prepared as follows, the table showing the reaction conditions and characteristics for each example, corresponding to the description of **Example 4** given above:-

CR1

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DEAD mg ; mmol	Mass mg	MS- ESI
	200 ; 0.3	44 ; 0.36	470 ; 1.8	170 ; 1.2	188	760 [M+ H] ⁺

- 15 Chromato. - EtOAc/CH₂Cl₂ (0 to 100% EtOAc).

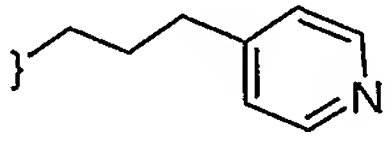
CR2

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DEAD mg ; mmol	Mass mg	MS- ESI
	200 ; 0.3	56 ; 0.37	470 ; 1.8	170 ; 1.2	202	788 [M+ H] ⁺

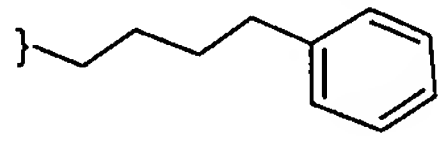
Chromato. - EtOAc/CH₂Cl₂ (50 to 100% EtOAc).

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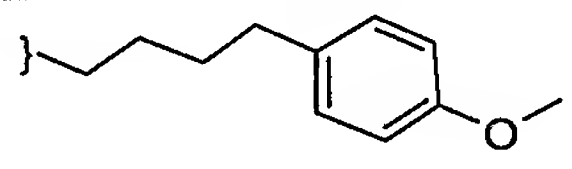
CR3

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DEAD mg ; mmol	Mass mg	MS- ESI
	80 ; 0.12	20 ; 0.15	192 ; 0.73	70 ; 0.49	68	774 [M+ H] ⁺

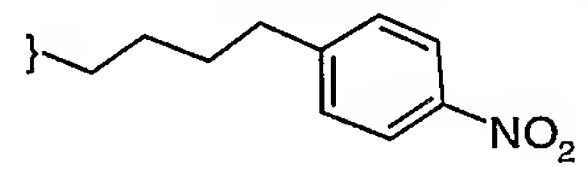
Chromato. - EtOAc/CH₂Cl₂ (0 to 100% EtOAc).**CR4**

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DEAD mg ; mmol	Mass mg	MS- ESI
	130 ; 0.2	36 ; 0.24	300 ; 1.13	100 ; 0.7	514	787 [M+H] ⁺

5 Chromato. - EtOAc/CH₂Cl₂ (0 to 40% EtOAc)**CR5**

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	327 ; 0.5	100 ; 0.6	786 ; 3	460 ; 2	nd*	nd*

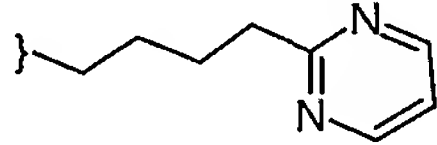
Chromato. - EtOAc/CH₂Cl₂ (0 to 50% EtOAc).10 **CR6**

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DEAD mg ; mmol	Mass mg	MS- ESI
	150 ; 0.23	53 ; 0.27	361 ; 1.38	0.145 ; 0.92	230	832 [M+ H] ⁺

Chromato. - EtOAc/CH₂Cl₂ (0 to 100% EtOAc).

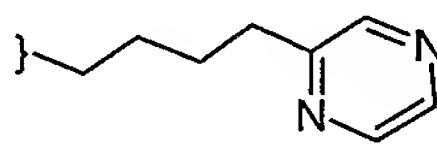
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CR7

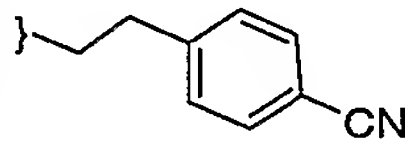
R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DEAD mg ; mmol	Mass mg	MS- ESI
	150 ; 0.23	42 ; 0.27	361 ; 1.38	0.145 ; 0.92	nd*	789 [M+H] ⁺

Chromato. - EtOAc

CR8

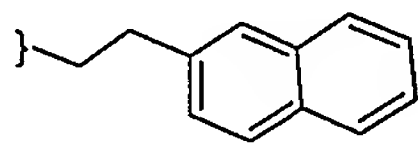
R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DEAD mg ; mmol	Mass mg	MS- ESI
	150 ; 0.23	42 ; 0.27	360 ; 138	0.15 ; 90	nd*	789 [M+H] ⁺

5 Chromato. - EtOAc/CH₂Cl₂ (0 to 100% EtOAc)**CR9**

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DEAD mg ; mmol	Mass mg	MS- ESI
	nd* ; 0.38	81 ; 0.55	724 ; 2.76	0.245 ; 1.55	94 ; 45%	nd*

Chromato. - EtOAc

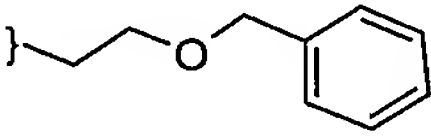
10 **CR10**

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	150 ; 0.23	47 ; 0.27	361 ; 1.38	212 ; 0.93	nd*	809 [M+H] ⁺

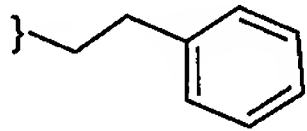
Chromato. - EtOAc/CH₂Cl₂ (0 to 70% EtOAc).

- 100 -

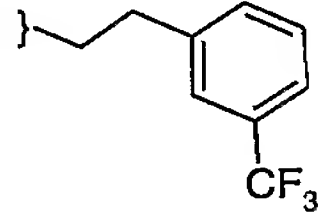
CR11

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	150 ; 0.23	42 ; 0.27	361 ; 1.38	212 ; 0.93	nd*	789 [M+H] ⁺

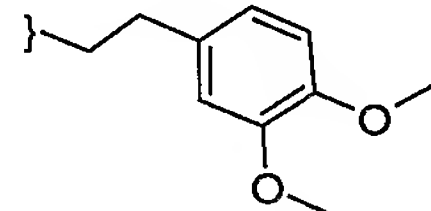
Chromato. - EtOAc/CH₂Cl₂ (0 to 70% EtOAc).**CR12**

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	300 ; 0.46	73 ; 0.6	723 ; 2.76	423 ; 1.84	nd*	nd*

5 Chromato. - EtOAc/CH₂Cl₂ (0 to 30% EtOAc).**CR13**

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	250 ; 0.38	95 ; 0.5	600 ; 2.28	350 ; 1.52	nd*	nd*

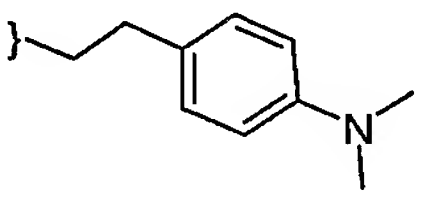
Chromato. - EtOAc/CH₂Cl₂ (0 to 40% EtOAc).10 **CR14**

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	164 ; 0.25	55 ; 0.3	362 ; 1.38	212 ; 0.92	nd*	nd*

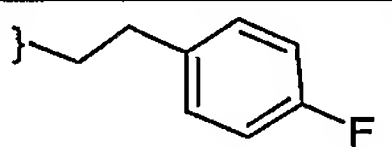
Chromato. - EtOAc/CH₂Cl₂ (0 to 70% EtOAc)

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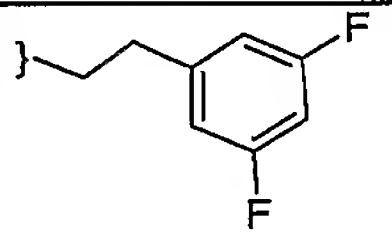
CR15

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	164 ; 0.25	49 ; 0.3	362 ; 1.38	212 ; 0.92	nd*	nd*

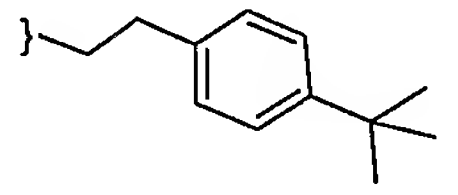
Chromato. - EtOAc/CH₂Cl₂ (0 to 100% EtOAc)**CR16**

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	300 ; 0.46	84 ; 0.6	723 ; 2.76	423 ; 1.84	nd*	777 [M+H] ⁺

5 Chromato. - EtOAc/CH₂Cl₂ (0 to 20 EtOAc).**CR18**

Cgx	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	150 ; 0.23	50 ; 0.3	367 ; 1.4	212 ; 0.92	40	nd*

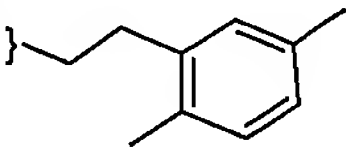
Chromato. - EtOAc/CH₂Cl₂ (0 to 20% EtOAc)10 **CR19**

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	163 ; 0.25	57 ; 0.32	393 ; 1.5	230 ; 1.0	nd*	nd*

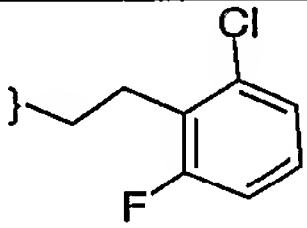
Chromato. - EtOAc/CH₂Cl₂ (0 to 20% EtOAc)

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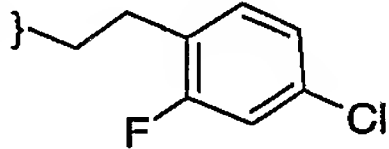
CR20

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	163 ; 0.25	48 ; 0.32	393 ; 1.5	230 ; 1.0	nd*	nd*

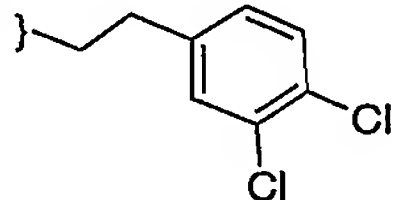
Chromato. - EtOAc/CH₂Cl₂ (0 to 20% EtOAc)**CR21**

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	163 ; 0.25	56 ; 0.32	393 ; 1.5	230 ; 1.0	nd*	nd*

5 Chromato. - EtOAc/CH₂Cl₂ (0 to 20% EtOAc)**CR22**

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	163 ; 0.25	56 ; 0.32	393 ; 1.5	230 ; 1.0	nd*	nd*

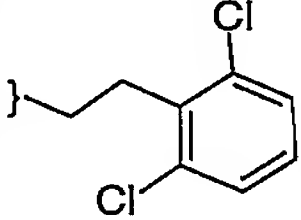
Chromato. - EtOAc/CH₂Cl₂ (0 to 20% EtOAc)10 **CR23**

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	163 ; 0.25	61 ; 0.32	393 ; 1.5	230 ; 1.0	nd*	nd*

Chromato. - EtOAc/CH₂Cl₂ (0 to 20% EtOAc)

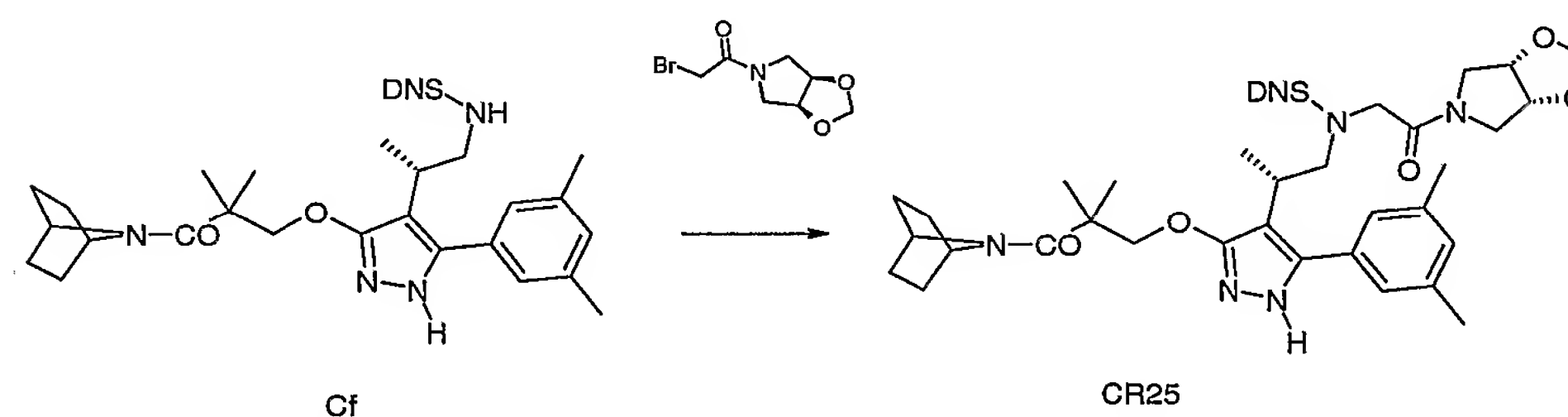
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CR24

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	163 ; 0.25	61 ; 0.32	393 ; 1.5	230 ; 1.0	nd*	nd*

Chromato. - EtOAc/CH₂Cl₂ (0 to 20% EtOAc)**CR25**

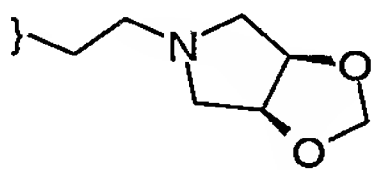
5 The intermediate **CR25** was prepared as follows:-



A solution of **Cf** (150 mg ; 0.23 mmol) in DMF (3 ml) was cooled to 0°C and treated with potassium *t*-butoxide (40 mg). The bromomethyl amide (82 mg ; 0.35 mmol) was added and the mixture allowed to warm to room temperature for 1 h. The mixture was treated with sat.

10 aq. NaHCO₃ and extracted with CH₂Cl₂. The organic phase was washed with water, brine and dried over MgSO₄. The crude product was used directly in the final step.

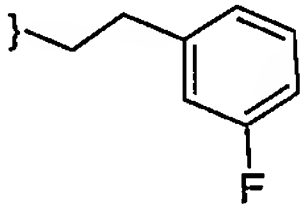
CR26

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	150 ; 0.23	48 ; 0.3	367 ; 1.4	212 ; 0.92	nd*	nd*

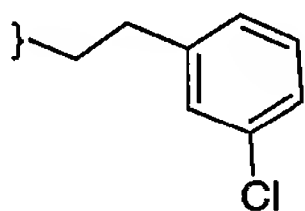
Chromato. - EtOAc/CH₂Cl₂ (0 to 20 EtOAc).

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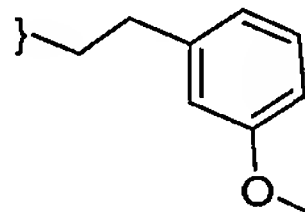
CR27

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	173 ; 0.26	45 ; 0.32	415 ; 1.58	243 ; 1.06	nd*	nd*

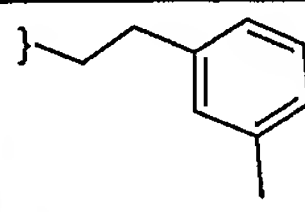
Chromato. - EtOAc/CH₂Cl₂ (0 to 20 EtOAc).**CR28**

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	173 ; 0.26	50 ; 0.32	415 ; 1.58	243 ; 1.06	nd*	nd*

5 Chromato. - EtOAc/CH₂Cl₂ (0 to 20 EtOAc).**CR29**

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	173 ; 0.26	49 ; 0.32	415 ; 1.58	243 ; 1.06	nd*	nd*

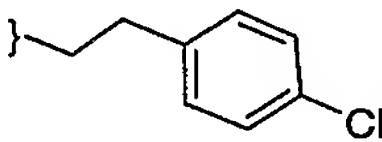
Chromato. - EtOAc/CH₂Cl₂ (0 to 20 EtOAc).10 **CR30**

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	173 ; 0.26	44 ; 0.32	415 ; 1.58	243 ; 1.06	nd*	nd*

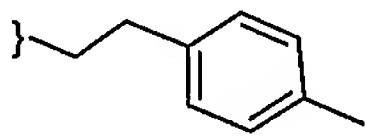
Chromato. - EtOAc/CH₂Cl₂ (0 to 20 EtOAc).

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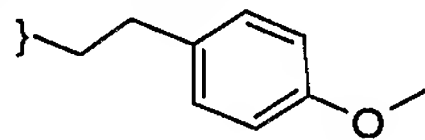
CR31

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	173 ; 0.26	50 ; 0.32	415 ; 1.58	243 ; 1.06	nd*	nd*

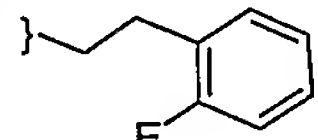
Chromato. - EtOAc/CH₂Cl₂ (0 to 20 EtOAc).**CR32**

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	173 ; 0.26	44 ; 0.32	415 ; 1.58	243 ; 1.06	nd*	nd*

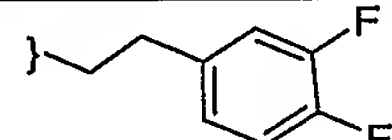
5 Chromato. - EtOAc/CH₂Cl₂ (0 to 20 EtOAc).**CR33**

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	173 ; 0.26	49 ; 0.32	415 ; 1.58	243 ; 1.06	nd*	nd*

Chromato. - EtOAc/CH₂Cl₂ (0 to 20 EtOAc).10 **CR34**

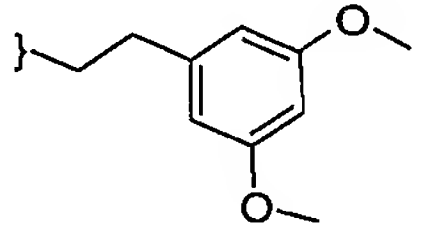
R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	173 ; 0.26	45 ; 0.32	415 ; 1.58	243 ; 1.06	nd*	nd*

Chromato. - EtOAc/CH₂Cl₂ (0 to 20 EtOAc).**CR36**

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	164 ; 0.25	52 ; 0.33	393 ; 1.5	230 ; 1	nd*	nd*

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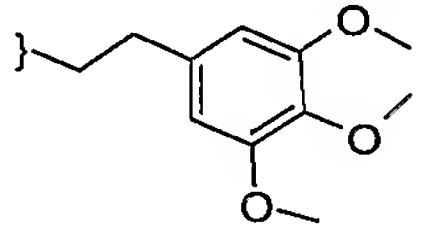
Chromato. - EtOAc/CH₂Cl₂ (10 to 50 EtOAc).**CR37**

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	164 ; 0.25	60 ; 0.33	393 ; 1.5	230 ; 1	nd*	nd*

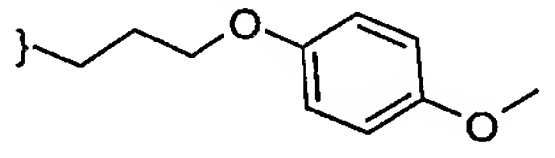
Chromato. - EtOAc/CH₂Cl₂ (10 to 50 EtOAc).

5

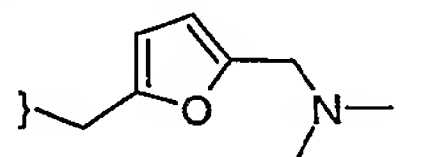
CR38

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	164 ; 0.25	70 ; 0.33	393 ; 1.5	230 ; 1	nd*	nd*

Chromato. - EtOAc/CH₂Cl₂ (10 to 50 EtOAc).**CR39**

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	164 ; 0.25	60 ; 0.33	393 ; 1.5	230 ; 1	nd*	nd*

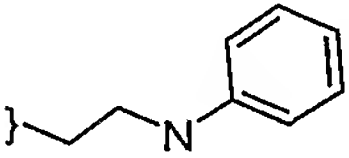
10 Chromato. - EtOAc/CH₂Cl₂ (10 to 50 EtOAc).**CR40**

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	164 ; 0.25	63 ; 0.33	393 ; 1.5	230 ; 1	nd*	nd*

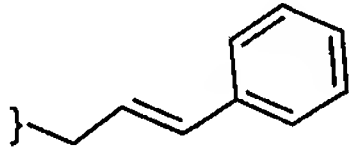
Chromato. - EtOAc/CH₂Cl₂ (10 to 50 EtOAc).

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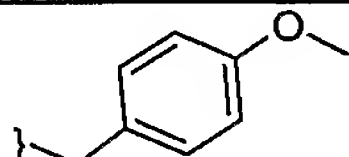
CR41

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	164 ; 0.25	45 ; 0.33	393 ; 1.5	230 ; 1	nd*	nd*

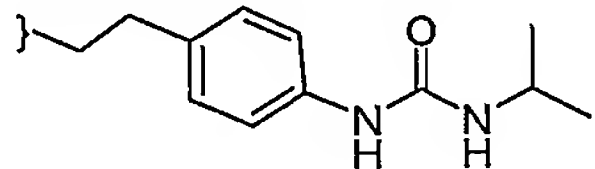
Chromato. - EtOAc/CH₂Cl₂ (10 to 50 EtOAc).**CR42**

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	164 ; 0.25	44 ; 0.33	393 ; 1.5	230 ; 1	nd*	nd*

5 Chromato. - EtOAc/CH₂Cl₂ (10 to 50 EtOAc).**CR43**

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	164 ; 0.25	46 ; 0.33	393 ; 1.5	230 ; 1	nd*	nd*

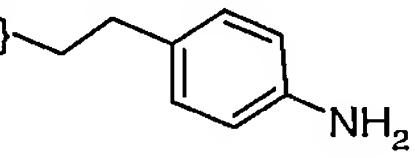
Chromato. - EtOAc/CH₂Cl₂ (10 to 50 EtOAc).10 **CR44**

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	164 ; 0.25	75 ; 0.33	393 ; 1.5	230 ; 1	nd*	859 [M+H] ⁺

Chromato. - EtOAc/CH₂Cl₂ (0 to 100% EtOAc)

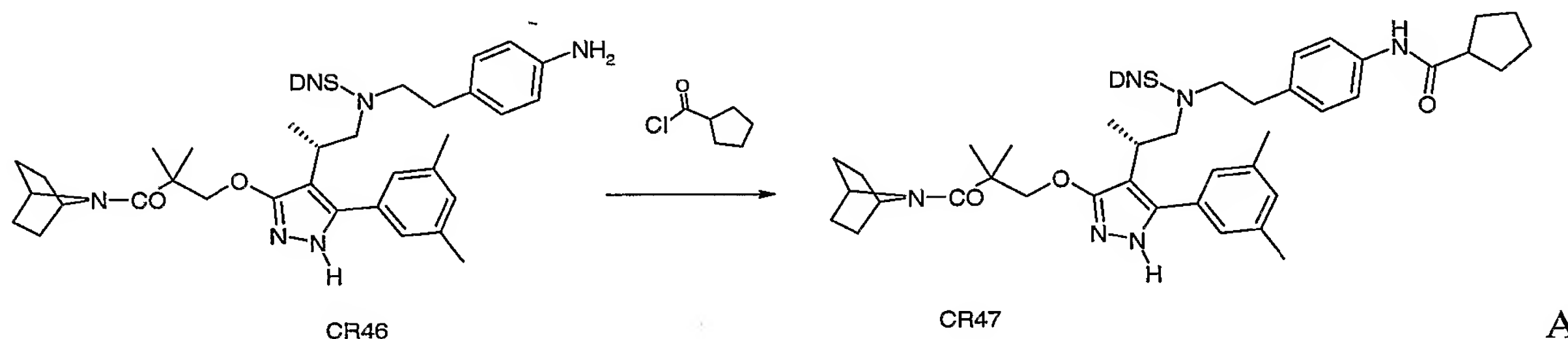
- 108 -

CR45

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	410 ; 0.62	130 ; 0.94	975 ; 3.72	570 ; 2.48	458 (95%)	774 [M+H] ⁺

Chromato. - EtOAc/CH₂Cl₂ (0 to 100% EtOAc)

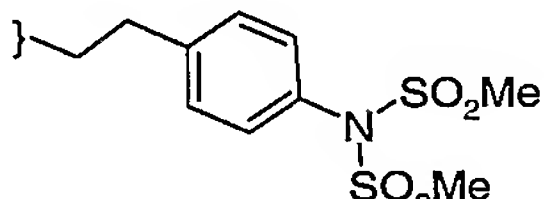
¹H NMR spectrum (DMSO d₆) : 1.16 (d, 3H) ; 1.28 (s, 6H) ; 1.42 (m, 4H) ; 1.60 (m, 4H) ; 2.28 (s, 6H) ; 2.40 (m, 2H) ; 3.06 (m, 1H) ; 3.18 (m, 2H) ; 3.45-3.75 (m, 2H) ; 4.17 (dd, 2H) ; 4.56 (s, 2H) ; 4.86 (s, 2H) ; 6.37 (d, 2H) ; 6.61 (d, 2H) ; 7.01 (s, 3H) ; 8.08 (d, 1H) ; 8.43 (dd, 1H) ; 8.86 (d, 1H) ; 11.8 (s br, 1H).

CR47

10 solution of **CR46** (108 mg ; 0.14 mmol) in CH₂Cl₂ (2 ml) was cooled to 0°C and treated with DIEA (27 μl ; 0.154 mmol). A solution of the acid chloride (14 μl ; 0.11 mmol) in CH₂Cl₂ (1 ml) was added and the mixture allowed to warm to room temperature. The crude mixture was deprotected as described for **C47** above.

15 **CR48**

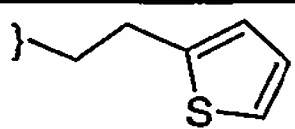
This intermediate was prepared using a method analogous to the preparation of CR47.

R	Cg46 mg ; mmol	DIEA μl ; mmol	Acid chloride μl ; mmol	CH ₂ Cl ₂	Mass mg	MS- ESI
	120 ; 0.15	29 ; 0.16	30 ; 0.36	3	nd*	nd*

Chromato. - EtOAc

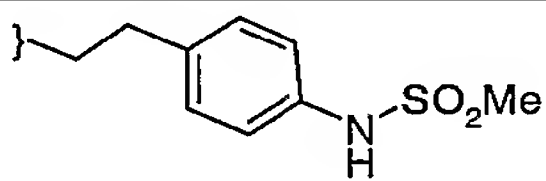
- 109 -

CR49

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	164 ; 0.25	50 ; 0.37	393 ; 1.5	230 ; 1	nd*	nd*

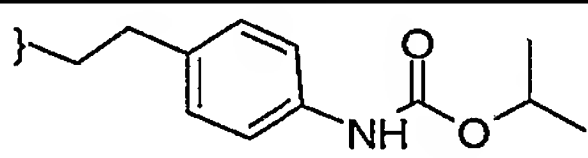
Chromato. - EtOAc/CH₂Cl₂ (0 to 50% EtOAc)**CR50**

5 This intermediate was prepared using a method analogous to the preparation of CR47.

R	CR46 mg ; mmol	DIEA μ l ; mmol	Acid chloride μ l ; mmol	CH ₂ Cl ₂	Mass mg	MS- ESI
	630 ; 0.6	315 ; 1.8	95 ; 1.2	50	nd*	nd*

Chromato. - EtOAc/CH₂Cl₂ (0 to 100% EtOAc)**CR51**

This intermediate was prepared using a method analogous to the preparation of CR47.

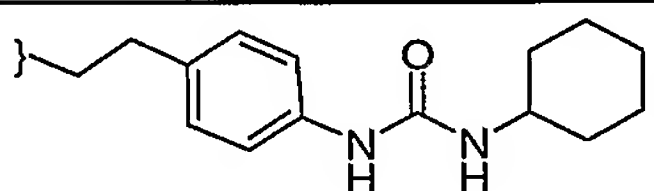
R	CR46 mg ; mmol	DIEA μ l ; mmol	Acid chloride μ l ; mmol	CH ₂ Cl ₂	Mass mg	MS- ESI
	120 ; 0.15	100 ; 0.6	300 1M ; 0.15	3	nd*	860 [M+ H] ⁺

10 Chromato. - EtOAc/CH₂Cl₂ (0 to 50% EtOAc)

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CR52

This intermediate was prepared using a method analogous to the preparation of CR47.

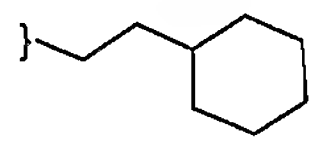
R	CR46 mg ; mmol	DIEA μ l ; mmol	Acid chloride** μ l ; mmol	CH ₂ Cl ₂	Mass mg	MS- ESI
	88 ; 0.11	100 ; 0.6	50 ; 0.4	10	nd*	nd*

Chromato. - EtOAc/CH₂Cl₂ (0 to 50% EtOAc)

** Cyclohexyl isocyanate was used in place of the corresponding acid chloride.

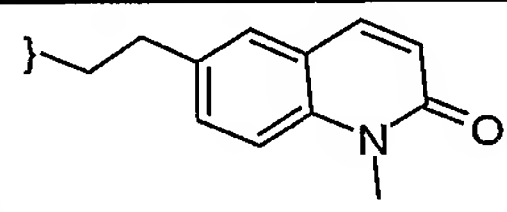
5

CR53

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	262 ; 0.4	102 ; 0.8	629 ; 2.4	368 ; 1.6	nd*	nd*

Chromato. - EtOAc/CH₂Cl₂ (0 to 20% EtOAc)

CR55

R	Cf mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	Mass mg	MS- ESI
	164 ; 0.25	70 ; 0.34	393 ; 1.5	230 ; 1	nd*	840 [M+H] ⁺

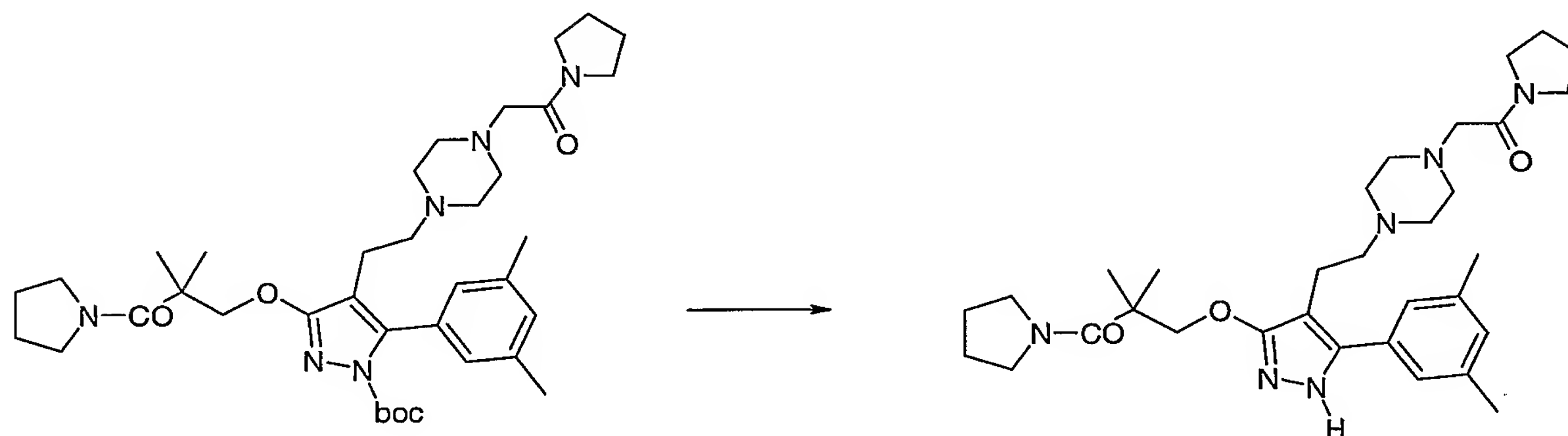
10 Chromato. - EtOAc/CH₂Cl₂ (0 to 20% EtOAc)

* nd = not determined, partially purified Cgx used directly for final step.

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Example 5

**3-[2,2-dimethyl-3-oxo-3-(pyrrolidin-1-yl)propoxy]-
4-[4-(2-pyrrolidin-1-yl-2-oxo-ethyl)piperzin-1-ylethyl]-5-(3,5-dimethylphenyl)-1H-
pyrazole**



5

DR1

Example 5

A

solution of **DR1** (350 mg ; 0.53 mmol) in pyrrolidine (2 ml) was heated at 45°C overnight. The pyrrolidine was evaporated and the residue purified by flash chromatography eluting with increasingly polar mixtures of MeOH/CH₂Cl₂ (0 to 7% MeOH) to give **Example 5** as a colourless foam (288 mg).

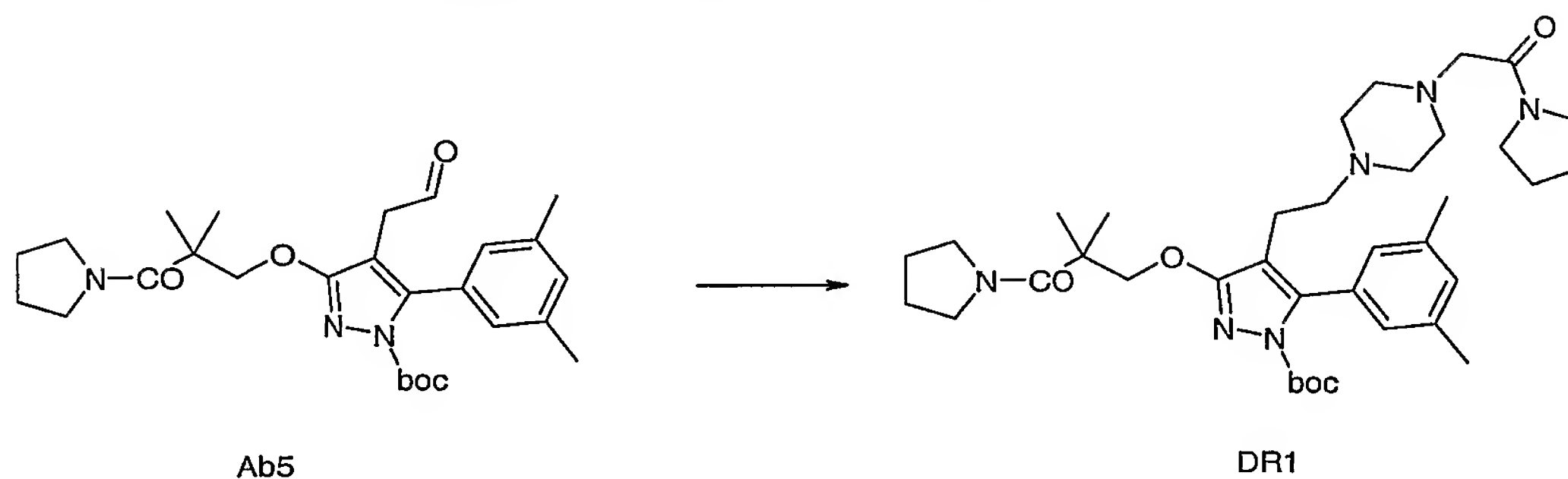
10 Yield : 97%

¹H NMR spectrum (CDCl₃) : 1.38 (s, 6H) ; 1.78 (m, 4H) ; 1.84 (m, 2H) ; 1.94 (m, 2H); 2.35 (s, 6H) ; 2.5-2.7 (m, 12H) ; 3.10 (s, 2H) ; 3.47 (t, 4H) ; 3.58 (m, 4H) ; 4.32 (s, 2H) ; 7.03 (s, 1H) ; 7.27 (s, 2H) ; 8.8 (s br, 1H).

MS-ESI : 565 [M+H]⁺

15

The starting material **DR1** was prepared as follows:-



Ab5

DR1

A solution of **Ab5** (242 mg ; 0.5 mmol) and 4-(4-aminobutyl)-pyrrolidine (125 mg ; 0.65 mmol) in DCE (5 ml) was treated with NaBH(OAc)₃ (425 mg ; 2.0 mmol). The mixture was stirred
20 for 20 h and evaporated. The residue was treated with aq. K₂CO₃ (10%) and the mixture

- 112 -

extracted with EtOAc. The organic phase was washed with water, brine and dried over MgSO_4 . The solution was evaporated to give pure **DR1** as a white solid (350 mg).

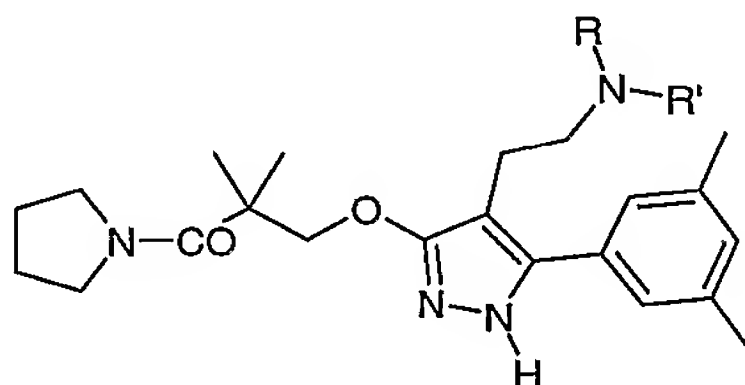
Yield : 100%

^1H NMR spectrum (CDCl_3) : 1.20 (s, 9H) ; 1.36 (s, 6H) ; 1.74 (s, 4H) ; 1.84 (m, 2H) ; 1.92 (m, 2H) ; 2.31 (s, 6H) ; 2.4-2.6 (m, 12H) ; 3.07 (s, 2H) ; 3.46 (t, 4H) ; 3.57 (m, 4H) ; 4.45 (s, 2H) ; 6.81 (s, 2H) ; 6.98 (s, 1H).

MS-ESI : 665 $[\text{M}+\text{H}]^+$

Examples 5.1-5.2

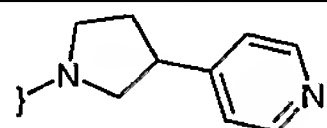
- 10 The following Example 5.1 was prepared in a similar manner to Example 5 and Example 5.2 was prepared in a manner similar to Example 2.



the table shows the **NRR'** group relating to the above structure, the reaction conditions and characteristics for each example, corresponding to the description of the preparation of

- 15 Example 5 given above:-

Example 5.1

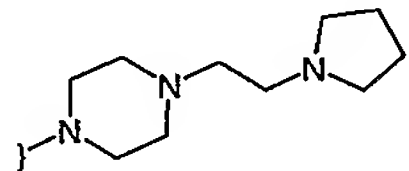
-NRR'	DR2 mg ; mmol	Pyrrolidine ml ; mmol	Prod. Form	Mass mg ; Yield	MS-ESI
	85 ; 0.14	2 ; 2.86	White glass	68 ; 96%	516 $[\text{M}+\text{H}]^+$

Chromato. -MeOH/ CH_2Cl_2 (7 to 10% MeOH)

- ^1H NMR spectrum (CDCl_3) : 1.39 (s, 6H) ; 1.70 (s, 4H) ; 1.83(m, 2H) ; 2.35 (s, 6H) ; 2.5-2.9 (m, 7H) ; 3.0 (m, 1H) ; 3.3 (m, 1H) ; 3.58 (m, 4H) ; 4.34 (dd, 2H) ; 7.03 (s, 1H) ; 7.04 (s, 2H) ; 7.17 (d, 2H) ; 8.48 (d, 2H) ; 8.9 (s br 1H).

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Example 5.2

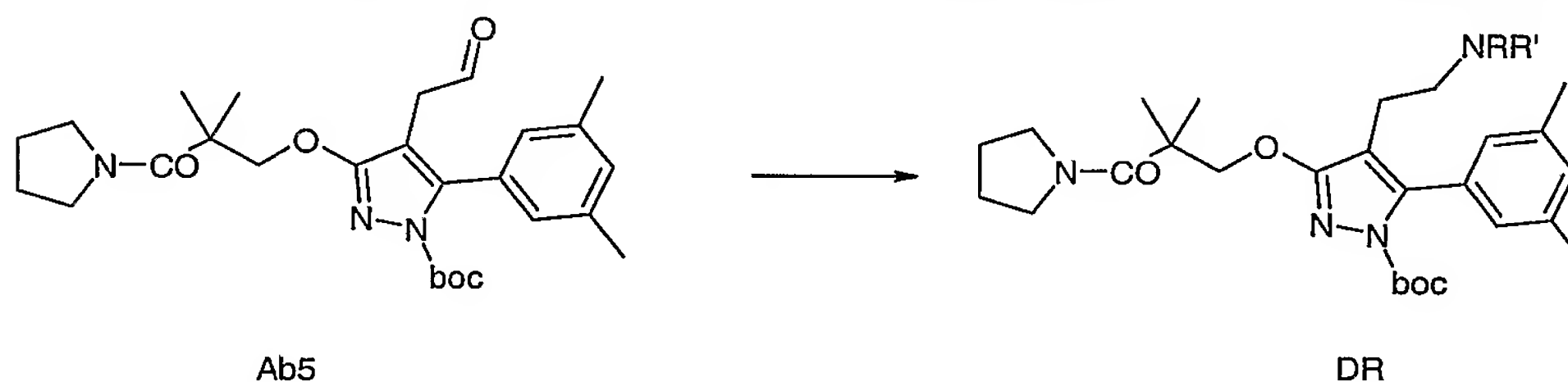
-NRR'	DR3 mg ; mmol	CH ₂ Cl ₂	Prod. Form	Mass mg ; Yield	MS-ESI
	194 ; 0.3	2	White solid	86 ; 52%	551 [M+H] ⁺

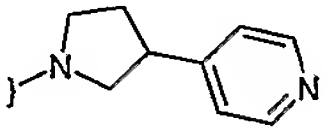
Chromato. – LC/MS H₂O/MeCN buffered with ammonium carbonate at pH 8.9 (0 to 100% H₂O)

¹H NMR spectrum (CDCl₃) : 1.36 (s, 6H) ; 1.74 (m, 4H) ; 1.83(m, 4H) ; 2.32 (s, 6H) ; 2.4-2.7 (m, 20H) ; 3.56 (m, 4H) ; 4.30 (s, 2H) ; 7.01 (s, 1H) ; 7.02 (s, 2H) ; 8.8 (s br 1H).

Intermediates for Examples 5.1-5.2, DR2 – DR3 respectively

Starting materials **DR2-3** were prepared as follows, the table showing the reaction conditions and characteristics for each example, corresponding to the description of **DR1** given above:-

**DR2**

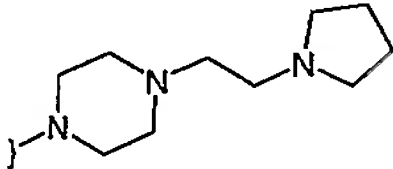
-NRR'	Ab5 mg ; mmol	Amine mg ; mmol	NaBH(OAc) ₃ mg ; mmol	Mass m g ; Yield	MS-ESI
	150 ; 0.31	60 ; 0.39	200 ; 0.93	117 ; 61%	616 [M+H] ⁺

Chromato. –EtOAc then MeOH/CH₂Cl₂ (5% MeOH)

¹H NMR spectrum (CDCl₃) : 1.20 (s, 9H) ; 1.37 (s, 6H) ; 1.70 (s, 4H) ; 1.90 (m, 2H) ; 2.30 (s, 6H) ; 2.4-2.7 (m, 7H) ; 2.9 (m, 1H) ; 3.3 (m, 1H) ; 3.56 (m, 4H) ; 4.47 (dd, 2H) ; 6.80 (s, 2H) ; 6.99 (s, 1H) ; 7.15 (d, 2H) ; 8.48 (d, 2H).

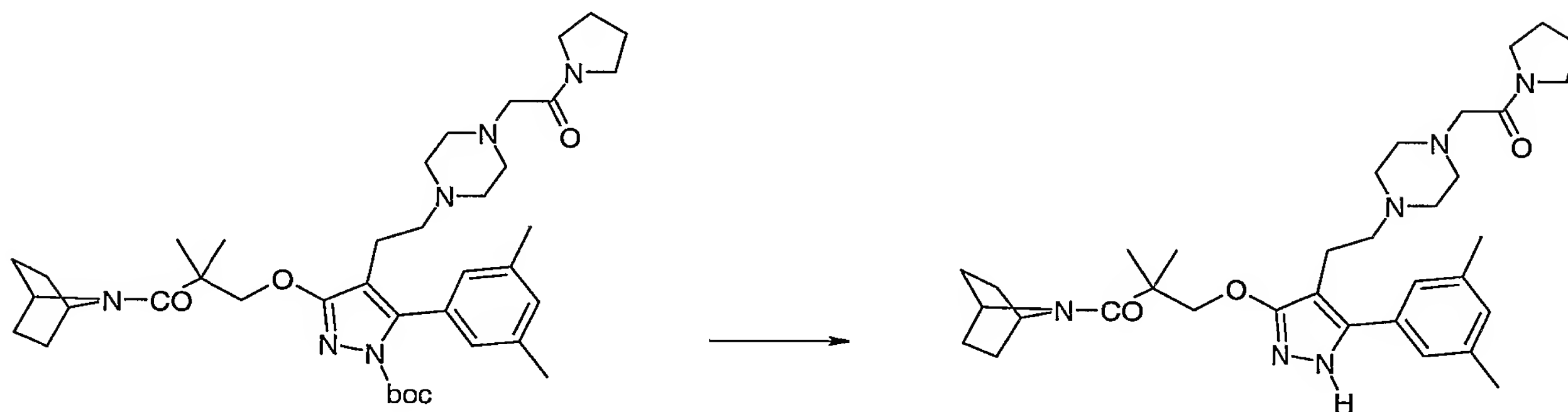
- 114 -

DR3

-NRR'	Ab5 mg ; mmol	Amine mg ; mmol	NaBH ₄ mg ; mmol	Mass mg ; Yield	MS-ESI
	265 ; 0.55	110 ; 0.6	38 ; 0.6 + AcOH 35 μ M	194 ; 54%	651 [M+H] ⁺

Chromato. – Ammonia in MeOH(7N)/CH₂Cl₂ (0 to 10% ammonia in MeOH).**Example 6**

- 5 **3-[2,2-dimethyl-3-oxo-3-(azabicyclo[2.2.1]heptan-7-yl)propoxy]-4-[4-(2-pyrrolidin-1-yl-2-oxo-ethyl)piperzin-1-ylethyl]-5-(3,5-dimethylphenyl)-1H-pyrazole**



ER1

Example 6

- A solution of **ER1** (160 mg ; 0.23 mmol) in pyrrolidine (1 ml) was heated at 45°C overnight.
- 10 The pyrrolidine was evaporated and the residue purified by flash chromatography eluting with increasingly polar mixtures of MeOH/CH₂Cl₂ (5 to 10% MeOH) to give **Example 6** as a white solid (141 mg).

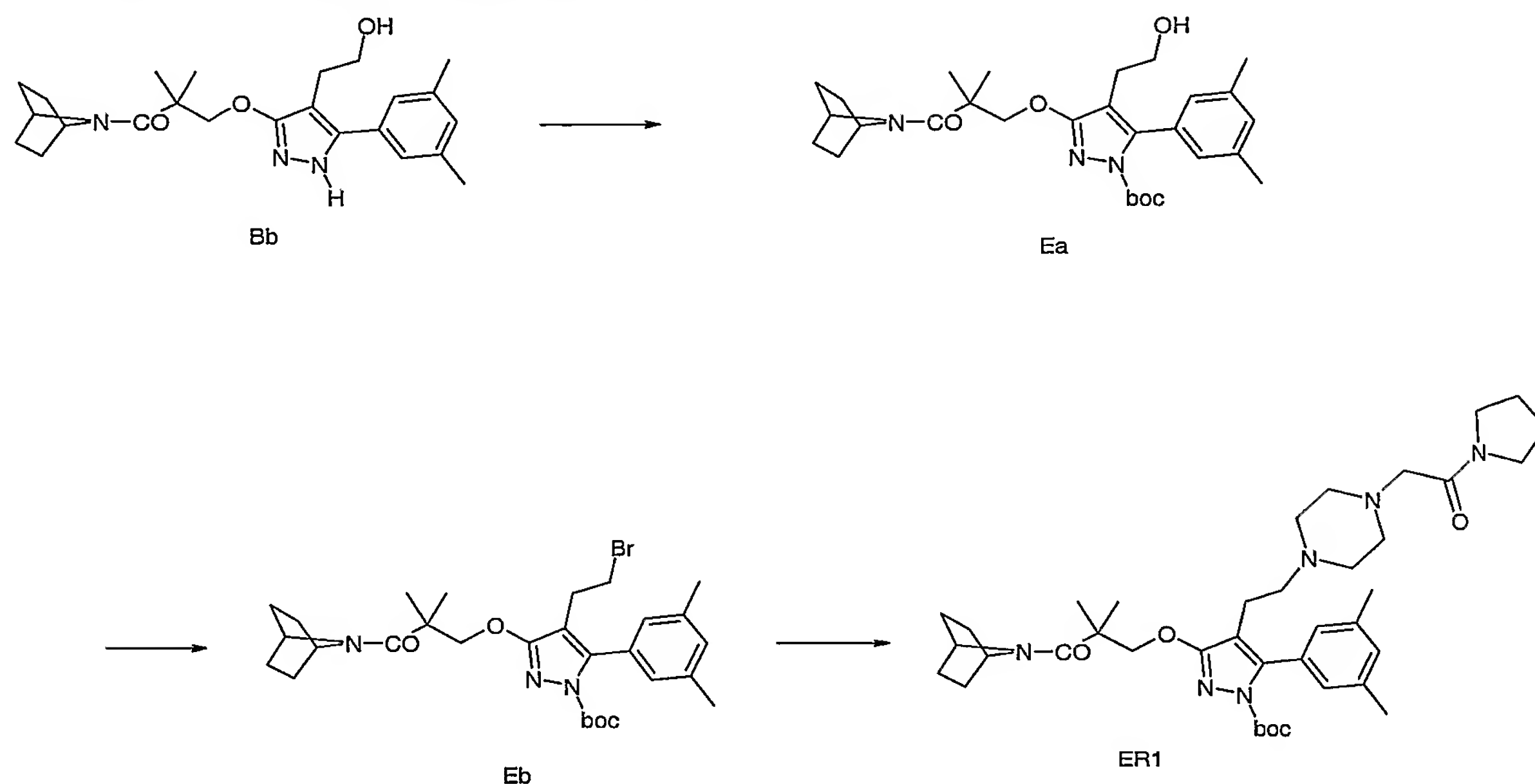
Yield : 100%

- ¹H NMR spectrum (CDCl₃) : 1.36 (s, 6H) ; 1.46 (m, 4H) ; 1.77 (m, 4H) ; 1.83 (m, 2H) ; 1.93 (m, 2H) ; 2.35 (s, 6H) ; 2.45-2.65 (m, 12H) ; 3.11 (s, 2H) ; 3.47 (m, 4H) ; 4.28 (s, 2H) ; 4.65 (s, 2H) ; 7.03 (s, 2H) ; 7.26 (s, 1H) ; 8.8 (s br, 1H).
- 15

MS-ESI : 591 [M+H]⁺

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Starting material **ER1** was prepared as follows:-



DMAP (100 mg ; cat.) was added to a solution of **Bb** (4.0 g ; 9.72 mmol) in a mixture of acetonitrile (175 ml) and CH₂Cl₂ (40 ml). The mixture was cooled to -10 °C and a solution of (BOC)₂O (2.54 g ; 11.66 mmol) in CH₂Cl₂ (50 ml) added dropwise during 1.5 h. The mixture was stirred for a further 2.5 h at -10°C to -5°C. Water was added and the mixture stirred overnight at room temperature. The mixture was extracted with CH₂Cl₂ and the organic phase washed with water, brine and dried over MgSO₄. The residue was purified by flash chromatography eluting with increasingly polar mixtures of EtOAc/CH₂Cl₂ (20 to 80% EtOAc) to give the alcohol **Ea** as colourless crystals (2.4 g).

Yield : 48%

¹H NMR spectrum (CDCl₃) : 1.20 (s, 9H) ; 1.34 (s, 6H) ; 1.45 (m, 4H) ; 1.77 (m, 4H) ; 2.32 (s, 6H) ; 2.42 (t, 2H) ; 3.63 (m, 2H) ; 4.42 (s, 2H) ; 4.65 (s, 2H) ; 6.83 (s, 2H) ; 7.00 (s, 1H)

MS-ESI : 512 [M+H]⁺

15

A solution of **Ea** (3.7 g ; 7.23 mmol) and CBr₄ (3.12 g ; 9.4 mmol) in CH₂Cl₂ (150 ml) was cooled to 0°C under argon. Solid PPh₃ (2.84 g ; 10.85 mmol) was added portionwise and the mixture allowed to warm to room temperature overnight. The mixture was directly purified by flash chromatography eluting with increasingly polar mixtures of EtOAc/CH₂Cl₂ (0 to 30% EtOAc) to give the bromide **Eb** as colourless crystals (3.01 g).

Yield : 73%

20

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¹H NMR spectrum (DMSO d₆) : 1.51 (s, 9H) ; 1.27 (s, 6H) ; 1.45 (m, 4H) ; 1.63 (m, 4H) ; 2.30 (s, 6H) ; 2.63 (t, 2H) ; 3.51 (t, 2H) ; 4.27 (s, 2H) ; 4.59 (s, 2H) ; 6.93 (s, 2H) ; 7.08 (s, 1H).

MS-ESI : 575 [M+H]⁺

5

A mixture of Eb (150 mg ; 0.26 mmol) and 1-(pyrrolidinocarbonylmethyl)piperazine (108 mg ; 0.548 mmol) in acetonitrile (5 ml) under argon was heated at 80°C for 16 h.

The solvent was evaporated and the residue was purified by flash chromatography eluting with increasingly polar mixtures of MeOH/CH₂Cl₂ (0 to 7% MeOH) to give ER1 as a beige

10 powder (161 mg).

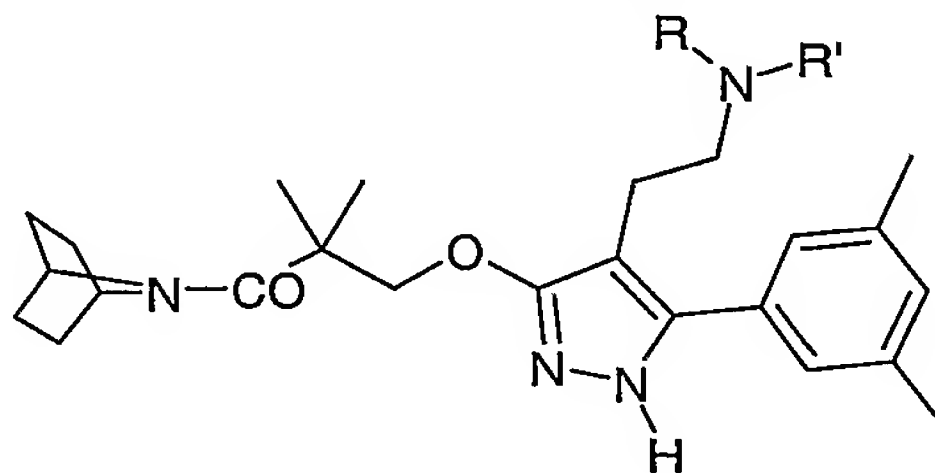
Yield : 89%

¹H NMR spectrum (CDCl₃) : 1.20 (s, 9H) ; 1.34 (s, 6H) ; 1.46 (m, 4H) ; 1.77 (m, 4H) ; 1.85 (m, 2H) ; 1.94 (m, 2H) ; 2.32 (s, 6H) ; 2.35-2.6 (m, 12H) ; 3.01 (s, 2H) ; 3.46 (m, 4H) ; 4.42 (s, 2H) ; 4.65 (s, 2H) ; 6.82 (s, 2H) ; 7.00 (s, 1H).

15 MS-ESI : 691 [M+H]⁺

Examples 6.1-6.10

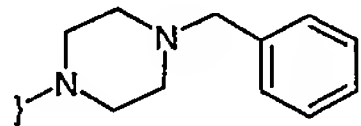
The following examples were prepared in a similar manner to Example 6,



20 the table shows the **NRR'** group relating to the above structure, the reaction conditions and characteristics for each example, corresponding to the description of the preparation of Example 6 given above. The final two steps were carried out without purification or characterisation of the intermediates **ER**:-

25

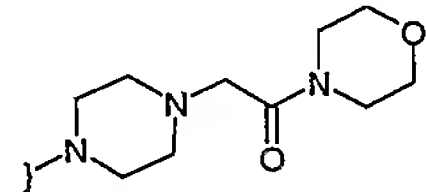
Example 6.1

-NRR'	Eb mg ; mmol	Piperazine mg ; mmol	Pyrrolidine ml	Mass mg ; Yield	MS-ESI
	172 ; 0.3	116 ; 0.66	4	146 ; 85%	570 [M+H] ⁺

Chromato. – Prep. LC/MS H₂O/MeCN buffered with ammonium carbonate at pH 8.9 (60% H₂O)

¹H NMR spectrum (DMSO d₆) : 1.24 (s, 6H) ; 1.41 (m, 4H) ; 1.61 (m, 4H) ; 2.30 (s, 6H) ; 2.3-2.6 (m, 12H) ; 3.43 (s, 2H) ; 4.14 (s, 2H) ; 4.56 (s, 2H) ; 7.01 (s, 1H) ; 7.10 (s, 2H) ; 7.3 (m, 5H) ; 11.7 (s br 1H).

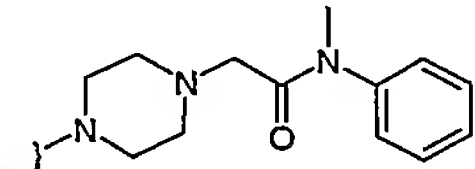
Example 6.2

-NRR'	Eb mg ; mmol	Piperazine mg ; mmol	Pyrrolidine ml	Mass mg ; Yield	MS-ESI
	115 ; 0.2	94 ; 0.44	3	105 ; 87%	607 [M+H] ⁺

Chromato. – Prep. LC/MS H₂O/MeCN buffered with ammonium carbonate at pH 8.9 (80% H₂O)

¹H NMR spectrum (DMSO d₆) : 1.25 (s, 6H) ; 1.42 (m, 4H) ; 1.61 (m, 4H) ; 2.31 (s, 6H) ; 2.3-2.6 (m, 12H) ; 3.10 (s, 2H) ; 3.35-3.6 (m, 8H) ; 4.15 (s, 2H) ; 4.57 (s, 2H) ; 7.02 (s, 1H) ; 7.10 (s, 2H) ; 11.7 (s br 1H).

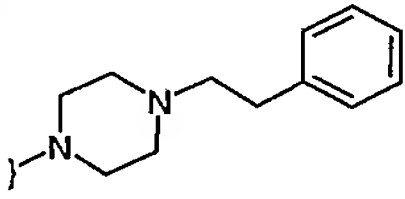
Example 6.3

-NRR'	Eb mg ; mmol	Piperazine mg ; mmol	Pyrrolidine ml	Mass mg ; Yield	MS-ESI
	115 ; 0.2	103 ; 0.44	3	96 ; 77%	627 [M+H] ⁺

Chromato. – Prep. LC/MS H₂O/MeCN buffered with ammonium carbonate at pH 8.9 (80% H₂O)

¹H NMR spectrum (DMSO d₆) : 1.25 (s, 6H) ; 1.42 (m, 4H) ; 1.61 (m, 4H) ; 2.30 (s, 6H) ; 2.3-2.6 (m, 12H) ; 2.85 (s br, 2H) ; 3.15 (s br, 3H) ; 4.14 (s, 2H) ; 4.57 (s, 2H) ; 7.01 (s, 1H) ; 7.09 (s, 2H) ; 7.32 (m, 3H) ; 7.41 (m, 2H) ; 11.7 (s br 1H).

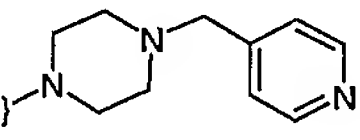
Example 6.4

-NRR'	Eb mg ; mmol	Piperazine mg ; mmol	Pyrrolidine ml	Mass mg ; Yield	MS-ESI
	115 ; 0.2	84 ; 0.44	3	27 ; 25%	584 [M+H] ⁺

Chromato. – Prep. LC/MS H₂O/MeCN buffered with ammonium carbonate at pH 8.9 (60% H₂O)

- 5 ¹H NMR spectrum (DMSO d₆) : 1.25 (s, 6H) ; 1.42 (m, 4H) ; 1.62 (m, 4H) ; 2.31 (s, 6H) ; 2.3-2.6 (m, 14H) ; 2.70 (t, 2H) ; 4.15 (s, 2H) ; 4.56 (s, 2H) ; 7.02 (s, 1H) ; 7.11 (s, 2H) ; 7.17 (t, 1H) 7.21 (d, 2H) ; 7.26 (t, 2H) ; 11.7 (s br 1H).

Example 6.5

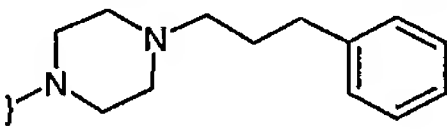
-NRR'	Eb mg ; mmol	Piperazine mg ; mmol	Pyrrolidine ml	Mass mg ; Yield	MS-ESI
	115 ; 0.2	78 ; 0.44	3	98 ; 86%	571 [M+H] ⁺

- 10 Chromato. – Prep. LC/MS H₂O/MeCN buffered with ammonium carbonate at pH 8.9 (80% H₂O)

¹H NMR spectrum (DMSO d₆) : 1.25 (s, 6H) ; 1.41 (m, 4H) ; 1.61 (m, 4H) ; 2.30 (s, 6H) ; 2.3-2.6 (m, 12H) ; 3.48 (s, 2H) ; 4.14 (s, 2H) ; 4.57 (s, 2H) ; 7.01 (s, 1H) ; 7.10 (s, 2H) ; 7.30 (d, 2H) ; 8.49 (dd, 2H) ; 11.7 (s br 1H).

15

Example 6.6

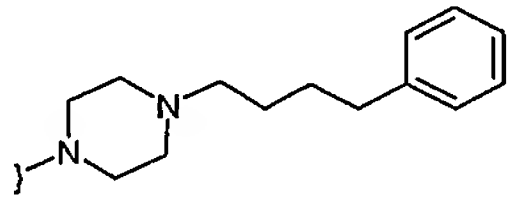
-NRR'	Eb mg ; mmol	Piperazine mg ; mmol	Pyrrolidine ml	Mass mg ; Yield	MS-ESI
	115 ; 0.2	90 ; 0.44	3	19 ; 16%	598 [M+H] ⁺

Chromato. – Prep. LC/MS H₂O/MeCN buffered with ammonium carbonate at pH 8.9 (60% H₂O)

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^1H NMR spectrum (DMSO d_6) : 1.25 (s, 6H) ; 1.42 (m, 4H) ; 1.62 (m, 4H) ; 1.69 (m, 2H) ; 2.23 (t, 2H) ; 2.30 (s, 6H) ; 2.3-2.7 (m, 14H) ; 4.14 (s, 2H) ; 4.57 (s, 2H) ; 7.01 (s, 1H) ; 7.10 (s, 2H) ; 7.17 (m, 3H) ; 7.27 (t, 2H) ; 11.7 (s br 1H).

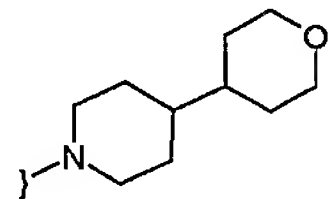
5 **Example 6.7**

-NRR'	Eb mg ; mmol	Piperazine mg ; mmol	Pyrrolidine ml	Mass mg ; Yield	MS-ESI
	115 ; 0.2	96 ; 0.44	3	108; 88%	612 [M+H] ⁺

Chromato. – Prep. LC/MS $\text{H}_2\text{O}/\text{MeCN}$ buffered with ammonium carbonate at pH 8.9 (60% H_2O)

^1H NMR spectrum (DMSO d_6) : 1.25 (s, 6H) ; 1.42 (m, 6H) ; 1.54 (m, 2H) ; 1.62 (m, 4H) ; 2.23 (t, 2H) ; 2.30 (s, 6H) ; 2.3-2.6 (m, 14H) ; 4.14 (s, 2H) ; 4.57 (s, 2H) ; 7.01 (s, 1H) ; 7.10 (s, 2H) ; 7.17 (m, 3H) ; 7.27 (t, 2H) ; 11.7 (s br 1H).

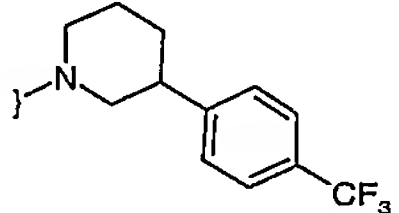
Example 6.8

-NRR'	Eb mg ; mmol	Piperazine mg ; mmol	Pyrrolidine ml	Mass mg ; Yield	MS-ESI
	115 ; 0.2	75 ; 0.44	3	91 ; 81%	563 [M+H] ⁺

Chromato. – Prep. LC/MS $\text{H}_2\text{O}/\text{MeCN}$ buffered with ammonium carbonate at pH 8.9 (80% H_2O)

15 ^1H NMR spectrum (DMSO d_6) : 0.99 (m, 1H) ; 1.15 (m, 3H) ; 1.27 (s, 6H) ; 1.45 (m, 4H) ; 1.55-1.65 (m, 8H) ; 1.85 (t, 2H) ; 2.32 (s, 6H) ; 2.3-2.6 (m, 6H) ; 2.88 (d 2H) ; 3.25 (t, 2H) ; 3.86 (m, 2H) ; 4.16 (s, 2H) ; 4.59 (s, 2H) ; 7.03 (s, 1H) ; 7.12 (s, 2H) ; 11.86 (s br 1H).

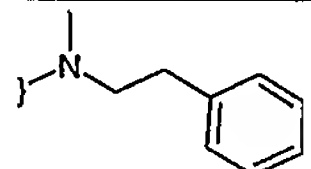
Example 6.9

-NRR'	Eb mg ; mmol	Piperazine mg ; mmol	Pyrrolidine ml	Mass mg ; Yield	MS-ESI
	230 ; 0.4	223 ; 0.84	10	234 ; 94%	623 [M+H] ⁺

Chromato. – MeOH/CH₂Cl₂ (0 to 10% MeOH)

¹H NMR spectrum (CDCl₃) + CD₃OD) : 1.26 (m, 6H) ; 1.37 (m, 4H) ; 1.60 (m, 4H) ; 1.71 (m, 1H) ; 1.97 (m, 2H) ; 2.1 (m, 1H) ; 2.27 (s, 6H) ; 2.8-3.0 (m, 4H) ; 3.15 (m, 2H) ; 3.31 m, 5 1H) ; 3.61 (m, 2H) ; 4.14 (dd, 2H) ; 4.47 (s, 2H) ; 6.96 (s, 3H) ; 7.36 (d, 2H) ; 7.52 (d, 2H) ; 8.9 (s br, 1H).

Example 6.10

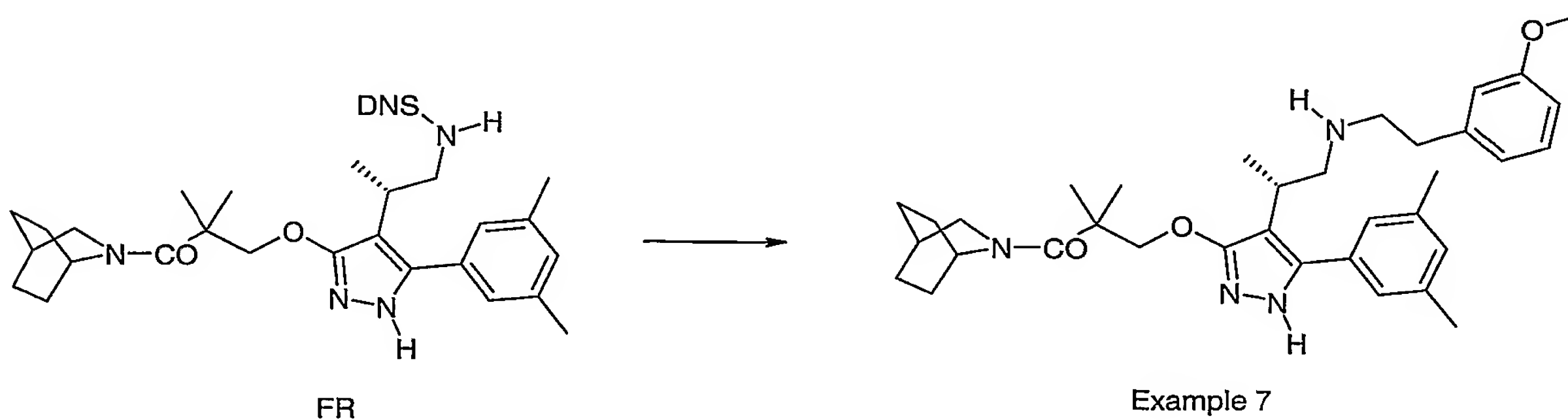
-NRR'	Eb mg ; mmol	Piperazine mg ; mmol	Pyrrolidine ml	Mass mg ; Yield	MS-ESI
	230 ; 0.4	113 ; 0.84	10	166 ; 79%	529 [M+H] ⁺

Chromato. – MeOH/CH₂Cl₂ (0 to 10% MeOH)

10 ¹H NMR spectrum (CDCl₃) : 1.36 (s, 6H) ; 1.43 (m, 4H) ; 1.75 (m, 4H) ; 2.33 (s, 6H) ; 2.39 (s, 3H) ; 2.6-2.8 (m, 8H) ; 4.29 (s, 2H) ; 4.64 (s, 2H) ; 7.02 (s, 1H) ; 7.05 (s, 2H) ; 7.17 (m, 3H) ; 7.26 (m, 2H) ; 8.9 (s br 1H).

Example 7

15 3-[3-(2,2-dimethyl-3-oxo-3-{azabicyclo[2.2.2]oct-2-yl}propoxy)-5-(3,5-dimethylphenyl)-1H-pyrazol-4-yl]-N-[2-(3-methoxyphenyl)ethyl]-(2S)-propylamine



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A mixture of **FR** (167 mg ; 0.25 mmol), 3-(2-hydroxyethyl)-methoxybenzene (50 mg ; 0.325 mmol) and triphenylphosphine (393 mg ; 1.5 mmol) in THF (5 ml) at 0°C under argon was treated with DTAD (230 mg ; 1.0 mmol). The mixture was allowed to warm to room temperature for 1 h when water was added. The mixture was extracted with CH₂Cl₂ and the organic phase was washed with water, brine and dried over MgSO₄. The residue was taken up directly in CH₂Cl₂ (3 ml) and treated dropwise with n-propylamine (150 µl ; 2.5 mmol). The mixture was stirred at room temperature for 1h and then purified directly by flash chromatography eluting with increasingly polar mixtures of CH₂Cl₂ and then MeOH/CH₂Cl₂ (0 to 10% MeOH) to give **Example 7** as a white foam (100 mg).

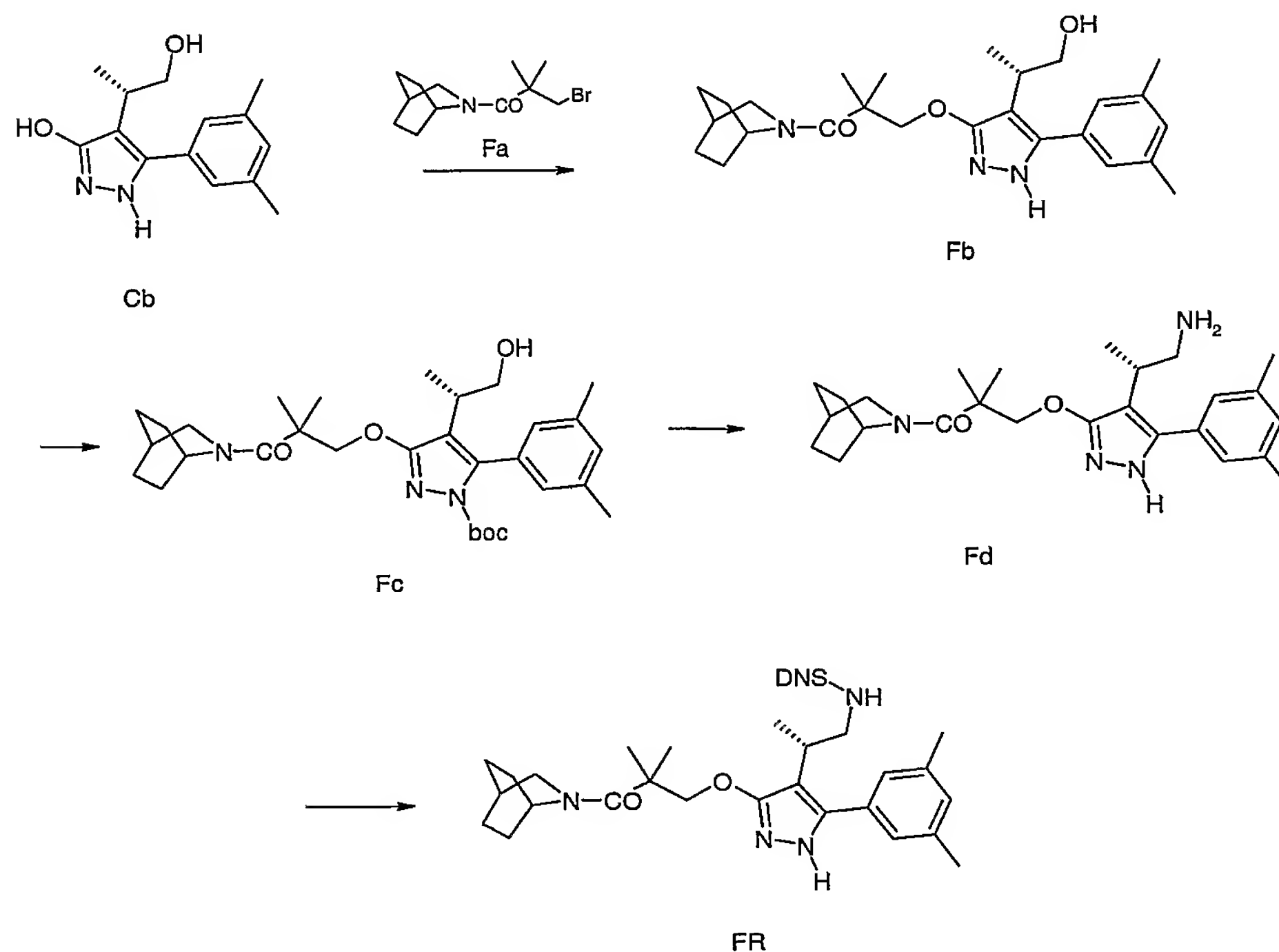
10 Yield : 70%

¹H NMR spectrum (DMSO d₆) : 1.15 (d, 3H) ; 1.27 (s, 6H) ; 1.54 (m, 4H) ; 1.67 (m, 4H) ; 1.85 (s, 1H) ; 2.3 (s, 6H) ; 2.55-2.95 (m, 7H) ; 3.24 (m, 2H) ; 3.7 (s, 3H) ; 4.16 (m, 3H) ; 6.7 (m, 3H) ; 7.03 (s, 1H) ; 7.05 (s, 2H) ; 7.15 (t, 1H) ; 11.8 (s br, 1H).

MS-ESI : 573 [M+H]⁺

15

The starting material **FR** was prepared as follows:-



This preparation was exactly analogous to that of Examples 4 and 8

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Yields and data are given in the following table: -

Compound	Yield	MS-ESI	RMN
Fb	85%	440 [M+H] ⁺	¹ H NMR spectrum (CDCl ₃) : 1.19 (d, 3H) ; 1.36 (s, 3H) ; 1.41 (s, 3H) ; 1.65 (m, 6H) ; 1.83 (m, 2H) ; 1.94 (s, 1H) ; 2.23 (m, 1H) ; 2.35 (s, 6H) ; 3.01 (m, 1H) ; 3.42 (m, 2H) ; 3.69 (m, 1H) ; 3.78 (m, 1H) ; 4.11 (m, 1H) ; 4.21 (m, 1H) ; 4.41 (m, 1H) ; 7.03 (s, 1H) ; 7.05 (s, 2H) ; 8.9 (s br 1H).
Fc	100%	540 [M+H] ⁺	¹ H NMR spectrum (CDCl ₃) : 1.06 (d, 3H) ; 1.19 (s, 9H) ; 1.36 (s, 3H) ; 1.42 (s, 3H) ; 1.56 (m, 6H) ; 1.83 (m, 2H) ; 1.94 (s, 1H) ; 2.25 (m, 1H) ; 2.35 (s, 6H) ; 2.59 (m, 1H) ; 3.41 (m, 2H) ; 3.57 (m, 1H) ; 3.67 (m, 1H) ; 4.11 (m, 1H) ; 4.30 (m, 1H) ; 4.60 (m, 1H) ; 6.84 (s, 2H) ; 7.00 (s, 1H).
Fd	85%	439 [M+H] ⁺	¹ H NMR spectrum (DMSO d ₆) : 1.16 (d, 3H) ; 1.27 (s, 6H) ; 1.56 (m, 4H) ; 1.68 (m, 4H) ; 1.87 (s, 1H) ; 2.31 (s, 6H) ; 2.36 (m, 2H) ; 2.72 (m, 1H) ; 4.15 (m, 3H) ; 7.02 (s, 1H) ; 7.07 (s, 2H) ; 8.9 (s br 1H).
FR	67%	669 [M+H] ⁺	¹ H NMR spectrum (DMSO d ₆) : 1.10 (d, 3H) ; 1.25 (s, 6H) ; 1.52 (m, 4H) ; 1.67 (m, 4H) ; 1.83 (s, 1H) ; 2.29 (s, 6H) ; 2.83 (m, 1H) ; 3.19 (m, 2H) ; 4.13 (m, 3H) ; 6.96 (s, 2H) ; 6.98 (s, 1H) ; 8.12 (d, 1H) ; 8.51 (br s, 1H) ; 8.52 (q, 1H) ; 8.79 (d, 1H) ; 11.9 (s br 1H).

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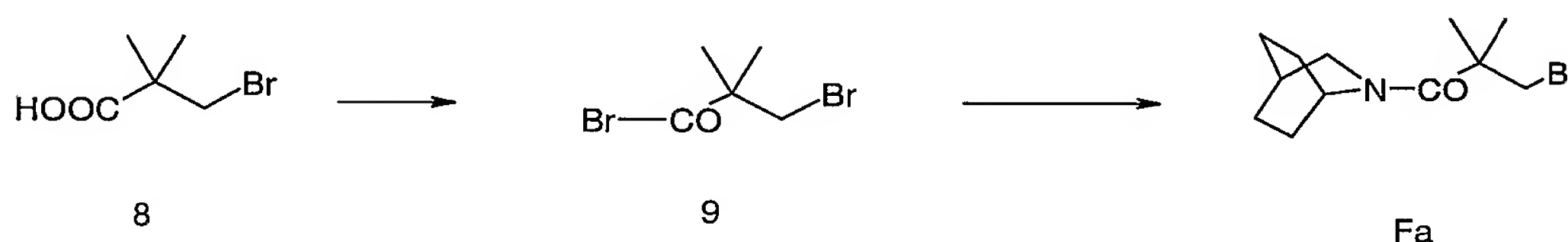
A solution of **Fd** (1.12g ; 2.55 mmol) in CH₂Cl₂ (50 ml) was cooled to 0°C under argon. DIEA (580 µl ; 3.3 mmol) was added followed by a solution of DNOSCl (0.72 g ; 2.68 mmol) in CH₂Cl₂ (10 ml). The mixture was allowed to warm to room temperature for 2 h and was treated with aq. HCl (1N). The mixture was extracted with CH₂Cl₂ and the organic phase was washed with water, brine and dried over MgSO₄. The residue was purified by flash chromatography eluting with increasingly polar mixtures of EtOAc/CH₂Cl₂ (0 to 40% EtOAc) to give **FR** as a yellow foam (1.14 g).

Yield : 67%

¹H NMR spectrum (DMSO d₆) : 1.10 (d, 3H) ; 1.25 (s, 6H) ; 1.52 (m, 4H) ; 1.67 (m, 4H) ; 1.83 (s, 1H) ; 2.29 (s, 6H) ; 2.83 (m, 1H) ; 3.19 (m, 2H) ; 4.13 (m, 3H) ; 6.96 (s, 2H) ; 6.98 (s, 1H) ; 8.12 (d, 1H) ; 8.51 (br s, 1H) ; 8.52 (q, 1H) ; 8.79 (d, 1H) ; 11.9 (s br 1H).

MS-ESI : 669 [M+H]⁺

Starting material **Fa** was prepared as follows:-



A mixture of **8** (4.0 g ; 22 mmol) and oxalyl bromide (9.5 g ; 44 mmol) containing one drop of DMF was heated at 50°C for 2h and then cooled. The excess of oxalyl bromide was evaporated and the residue azeotroped with toluene to give crude **9** which was taken up directly in CH₂Cl₂ (30 ml) and cooled to 0°C. Diisopropylethylamine (40 ml ; 200 mmol) was added followed by 2,2,2-azabicyclooctane (2.95 g ; 20 mmol) in CH₂Cl₂ (20 ml). The mixture was allowed to warm to room temperature overnight and was diluted with CH₂Cl₂, washed with aq. HCl (2N), aq. NaOH (1N), water, brine and dried over MgSO₄. The residue was evaporated to give **Fa** as a beige solid (3.75 g).

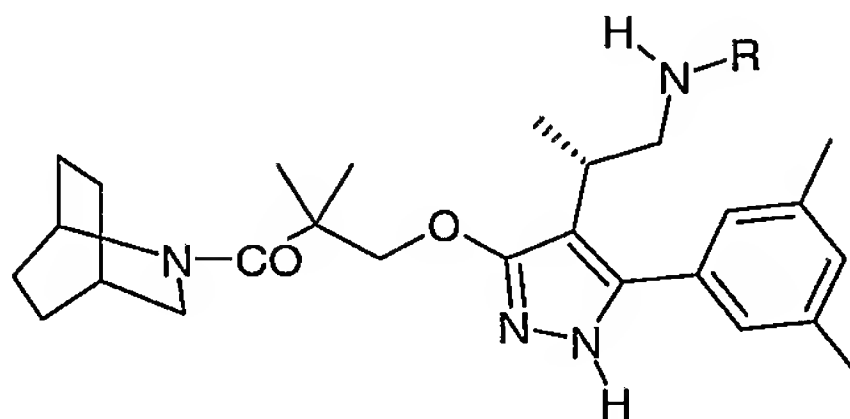
Yield : 68%

¹H NMR spectrum (CDCl₃) : 1.38 (s, 6H) ; 1.67 (m, 6H) ; 1.89 (m, 2H) ; 1.95 (s, 1H) ; 3.40 (m, 2H) ; 3.63 (s, 2H) 4.02 (s, 1H).

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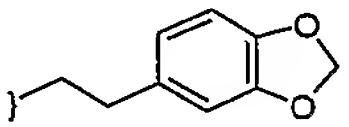
Example 7.1

The following example was prepared in a similar manner to Example 6,



- 5 The following example was prepared in a similar manner, the table shows the **NRR'** group relating to the above structure, the reaction conditions and characteristics for each example, corresponding to the description of the preparation of **Example 7** given above:-

Example 7.1

-NRR'	FR mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	nPrNH ₂ μl ; mmol	Mass mg ; Yield
	300 ; 0.45	150 ; 0.9	707 ; 2.7	415 ; 1.8	265 ; 4.5	193 ; 73%

10 Chromato. – EtOAc

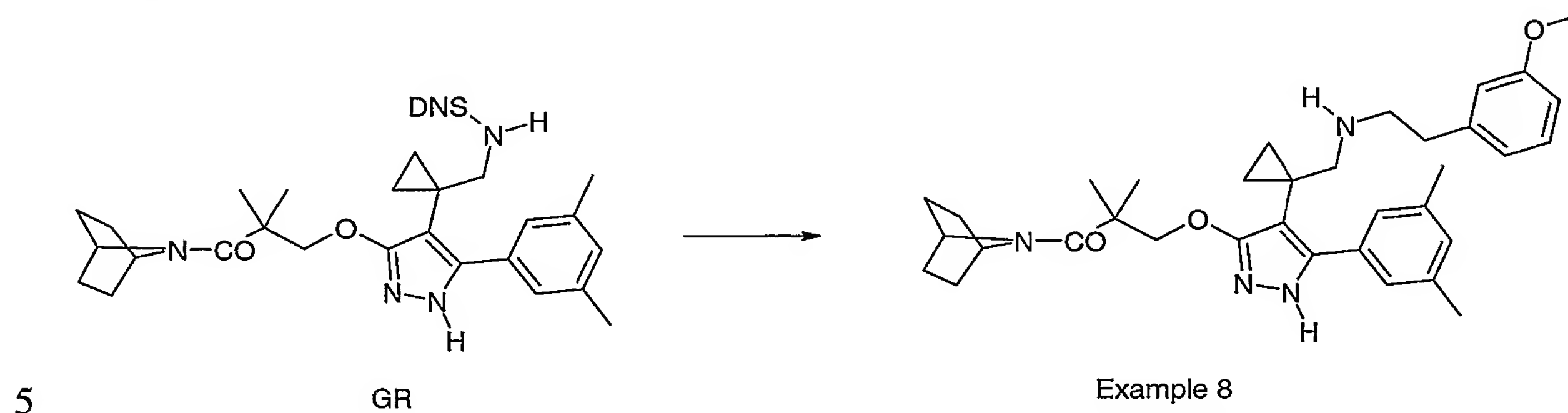
¹H NMR spectrum (DMSO d₆) : 1.13 (d, 3H) ; 1.27 (s, 6H) ; 1.55 (m, 4H) ; 1.68 (m, 4H) ; 1.86 (s, 1H) ; 2.3 (s, 6H) ; 2.55-2.95 (m, 7H) ; 3.31 (m, 2H) ; 4.14 (m, 3H) ; 5.93 (s, 2H) ; 6.53 (dd, 1H) ; 6.67 (d, 1H) ; 6.74 (d, 1H) ; 7.02 (s, 1H) ; 7.05 (s, 2H) ; 7.15 (t, 1H) ; 11.74 (s br, 1H).

15 MS-ESI : 587 [M+H]⁺

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Example 8

**3-[2,2-dimethyl-3-oxo-3-(azabicyclo[2.2.1]heptan-7-yl)propoxy]-
4-[1-(3-methoxyphenethylaminomethyl)cycloprop-1-yl]-5-(3,5-dimethylphenyl)-1H-
pyrazole**



Example 8 was prepared in a similar manner to Example 7, the table shows the reaction conditions and characteristics corresponding to the description of the preparation of Example 7 given above:-

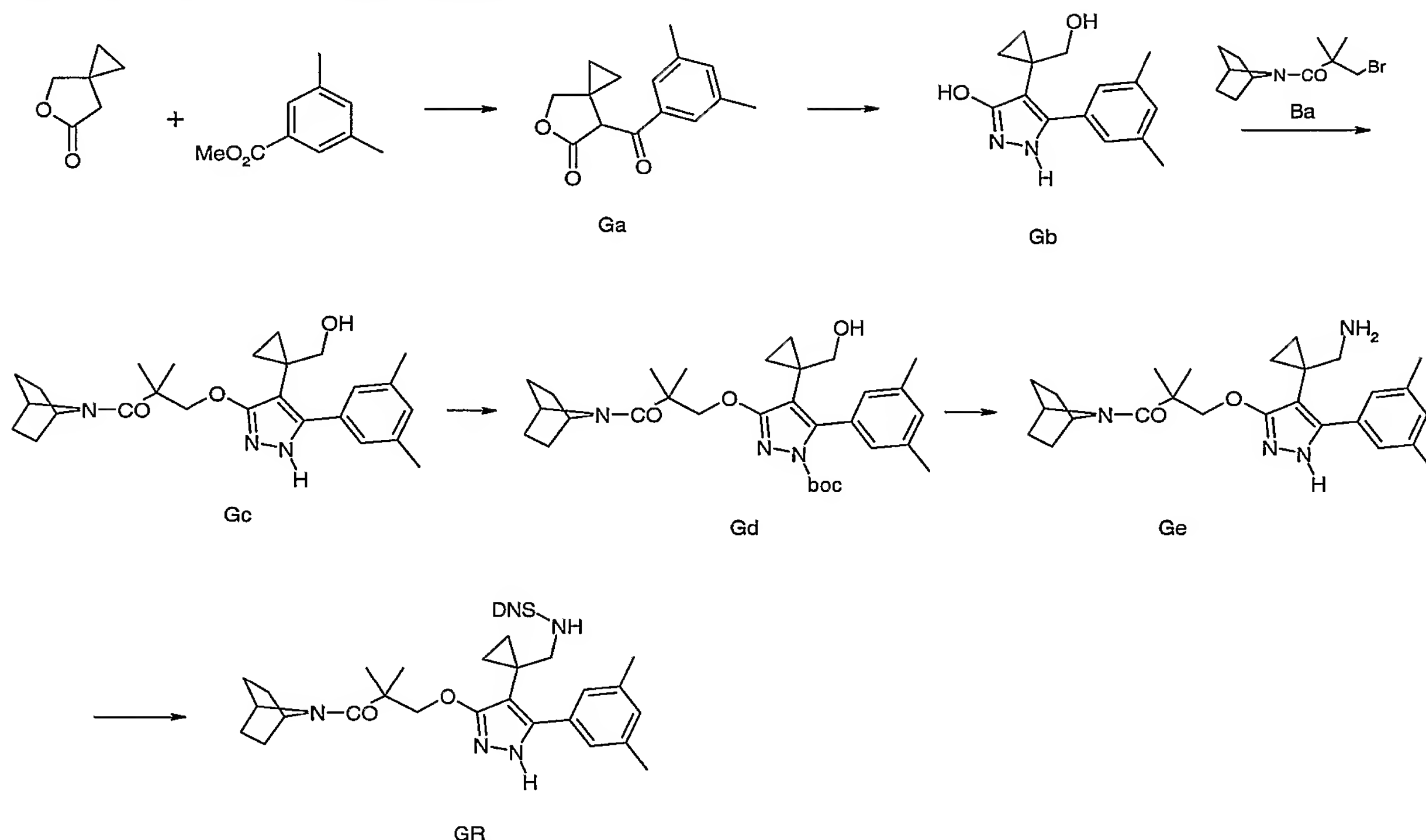
-NRR'	GR mg ; mmol	Alcohol mg ; mmol	Ph ₃ P mg ; mmol	DTAD mg ; mmol	nPrNH ₂ μl ; mmol	Mass mg ; Yield
	166 ; 0.25	50 ; 0.33	393 ; 1.5	230 ; 1.0	270 ; 10	68 ; 48%

Chromato. – MeOH/CH₂Cl₂ (0 to 10% MeOH)

10 ¹H NMR spectrum (DMSO d₆) : 0.42 (m, 2H) ; 0.70 (m, 2H) ; 1.25 (s, 6H) ; 1.42 (m, 4H) ; 1.62 (m, 4H) ; 2.3 (s, 6H) ; 2.6-2.85 (m, 7H) ; 3.69 (s, 3H) ; 4.14 (s, 3H) ; 4.57 (s, 2H) ; 6.71 (m, 3H) ; 7.03 (s, 1H) ; 7.15 (t, 1H) ; 7.33 (s, 2H) ; 11.74 (s br, 1H).

MS-ESI : 571 [M+H]⁺

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Starting material **GR** was prepared as follows:-

This preparation was exactly analogous to that of examples 4 and 7

5 Yields and data are given in the following table: -

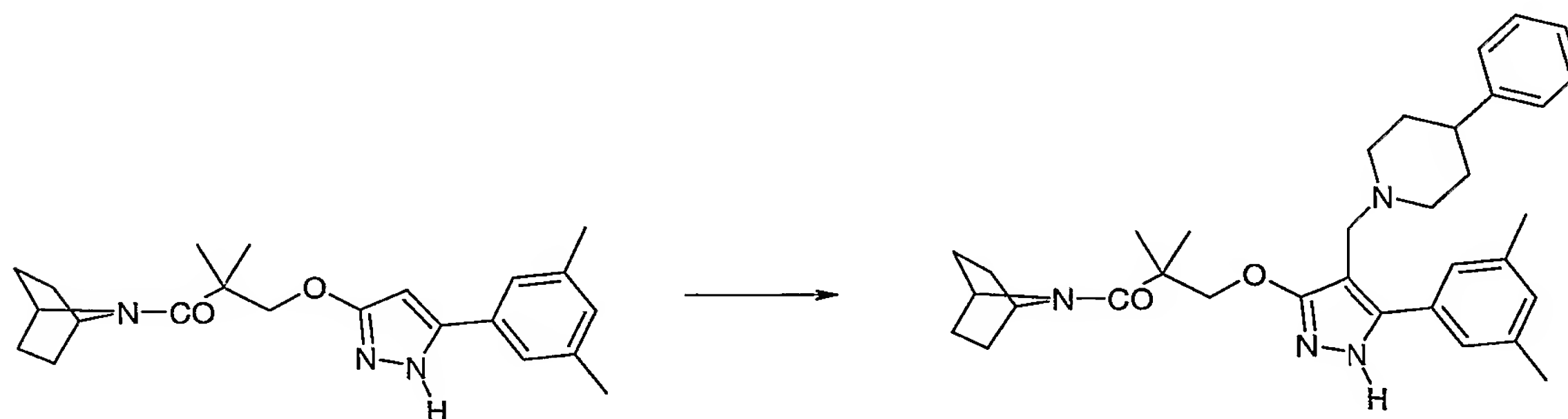
Compound	Yield	MS-ESI [M+H] ⁺	RMN
Ga	46%	245	¹ H NMR spectrum (DMSO d ₆) : 0.47 (m, 1H) ; 0.64 (m, 1H) ; 0.85 (m, 1H) ; 0.99 (m, 1H) ; 2.35 (s, 6H) ; 4.11 (d, 1H) ; 4.41 (d, 1H) ; 4.76 (s, 1H) ; 7.36 (s, 1H) ; 7.59 (s, 2H).
Gb	87%	259	¹ H NMR spectrum (DMSO d ₆) : 0.28 (m, 2H) ; 0.72 (m, 2H) ; 2.29 (s, 6H) ; 3.5 (s, 2H) ; 4.8 (s br, 1H) ; 6.96 (s, 1H) ; 7.34 (s, 2H) ; 9.3 (s br, 1H) ; 11.74 (s br, 1H).
Gc	69%	438	¹ H NMR spectrum (DMSO d ₆) : 0.27 (m, 2H) ; 0.70 (m, 2H) ; 1.27 (s, 6H) ; 1.42 (m, 4H) ; 1.64 (m, 4H) ; 2.3 (s, 6H) ; 3.43 (d, 2H) ; 4.14 (s, 2H) ; 4.59 (s, 2H) ; 4.64 (t, 1H) ; 6.99 (m, 1H) ; 7.41 (s, 2H) ; 11.74 (s br, 1H).

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Compound	Yield	MS-ESI [M+H] ⁺	RMN
Gd	60%	538	¹ H NMR spectrum (DMSO d ₆) : 0.17 (m, 2H) ; 0.46 (m, 2H) ; 1.14 (s, 9H) ; 1.29 (s, 6H) ; 1.45 (m, 4H) ; 1.65 (m, 4H) ; 2.3 (s, 6H) ; 3.31 (d, 2H) ; 4.23 (s, 2H) ; 4.59 (m, 3H) ; 7.01 (s, 2H) ; 7.04 (s, 1H).
Ge	65%	437	¹ H NMR spectrum (DMSO d ₆) : 0.35 (m, 2H) ; 0.67 (m, 2H) ; 1.27 (s, 6H) ; 1.43 (m, 4H) ; 1.64 (m, 4H) ; 2.3 (s, 6H) ; 2.63 (d, 2H) ; 4.15 (s, 2H) ; 4.58 (s, 2H) ; 6.99 (m, 1H) ; 7.31 (s, 2H) ; 11.74 (s br, 1H).
GR	90%	667	¹ H NMR spectrum (DMSO d ₆) : 0.38 (m, 2H) ; 0.8 (m, 2H) ; 1.28 (s, 6H) ; 1.42 (m, 4H) ; 1.62 (m, 4H) ; 2.3 (s, 6H) ; 3.17 (m, 2H) ; 4.14 (s, 2H) ; 4.57 (s, 2H) ; 6.98 (m, 1H) ; 7.27 (s, 2H) ; 7.98 (d, 1H) ; 8.51 (dd, 1H) ; 8.76 (d, 1H) ; 11.74 (s br, 1H).

Example 9

**3-[2,2-dimethyl-3-oxo-3-(azabicyclo[2.2.1]heptan-7-yl)propoxy]-
4-(4-phenylpiperidin-1-ylmethyl)-5-(3,5-dimethylphenyl)-1H-pyrazole**



Example 9

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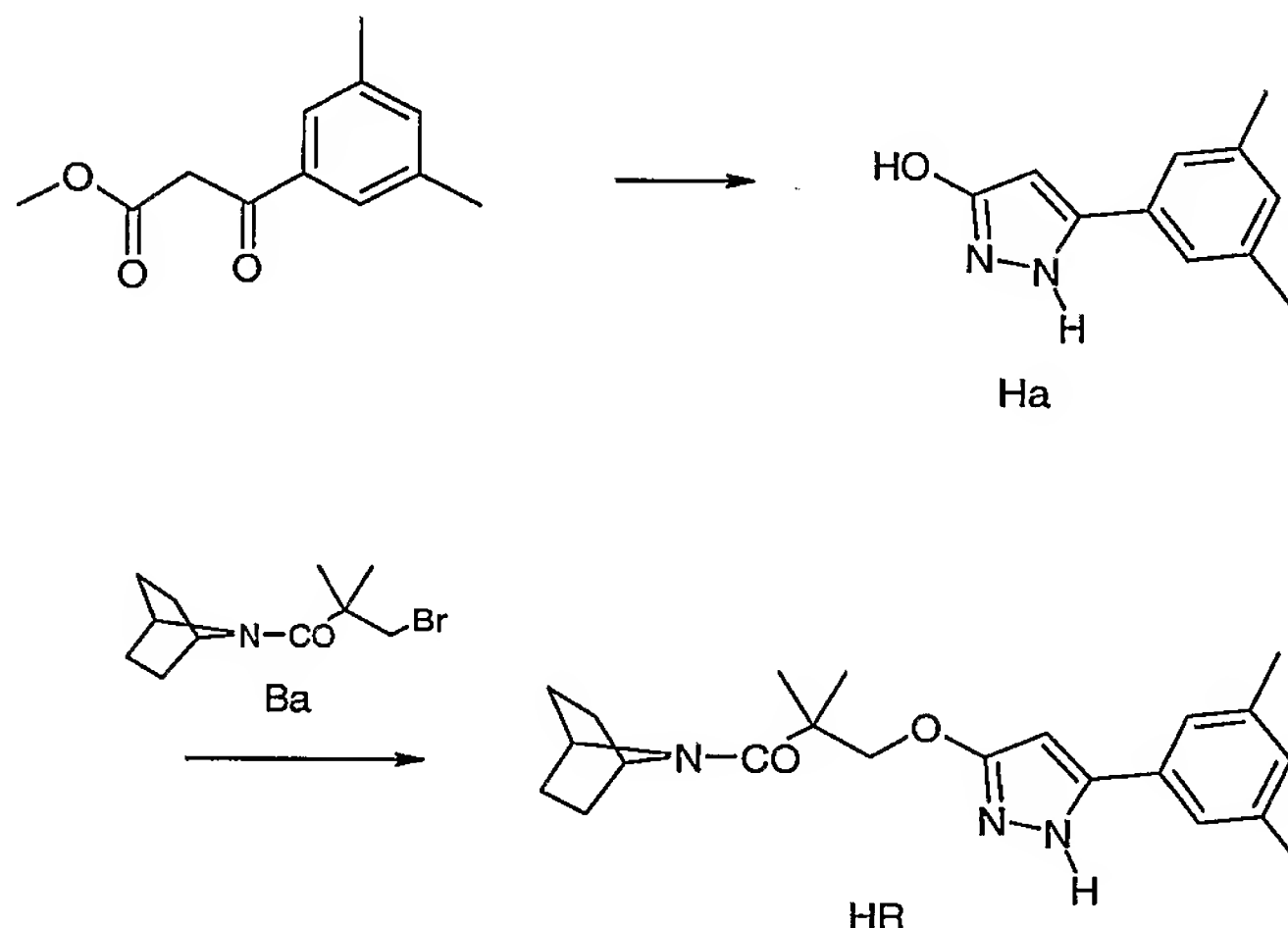
A mixture of 4-phenyl piperidine (98 mg ; 0.6 mmol) and formaldehyde (0.32 ml ; 4.0 mmol ; 37wt% aqueous solution) in water (0.2 ml) and acetic acid (0.2 ml) was stirred for 5 min and treated with **HR** (74 mg ; 0.2 mmol). The mixture was heated at 75°C for 2 h. The solvents were evaporated, MeOH (0.5 ml), water (0.5 ml) and ammonia in MeOH(7N) (0.6 ml) were added and the mixture stirred for a further 3 h. The solvents were evaporated and the residue was purified by preparative LC/MS chromatography with H₂O/MeCN buffered with ammonium carbonate at pH 8.9 (80% H₂O) to give **Example 9** as a white solid (75 mg).

Yield : 69%

¹H NMR spectrum (DMSO d₆) : 1.27 (s, 6H) ; 1.42 (m, 4H) ; 1.6 (m, 6H) ; 1.75 (m, 2H) ; 2.07 (m, 2H) ; 2.32 (s, 6H) ; 2.52 (m, 1H) ; 2.97 (m, 2H) ; 3.16 (s, 2H) ; 4.17 (s, 2H) ; 4.57 (s, 2H) ; 7.02 (s, 1H) ; 7.17 (t, 1H) ; 7.23 (d, 2H) ; 7.28 (t, 2H) 12.1 (s, 1H).

MS-ESI : 541 [M+H]⁺

15 The starting material **HR** was prepared as follows:-



A solution of 4-(3',5'-dimethylphenyl) acetoacetate (12.36 g ; 60 mmol) in EtOH (300 ml) was treated with hydrazine hydrate (5.82 ml ; 120 mmol) and heated under reflux for 3 h. The EtOH was evaporated and the residue triturated with Et₂O. The precipitate was collected, washed and dried to give **Ha** as a white powder (9.54 g).

Yield : 85%

¹H NMR spectrum (DMSO d₆) : 2.28 (s, 6H) ; 5.83 (s, 1H) ; 6.93 (s, 1H) ; 7.27 (s, 2H) ; 9.5 (s br, 1H).

MS-ESI : 189 [M+H]⁺

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A mixture of **Ha** (3.1 g ; 16.5 mmol) and **Ba** (5.15 g ; 19.8 mmol) in DMA (40 ml) under argon was treated with K₂CO₃ (4.56 g ; 33.0 mmol). The mixture was stirred and heated at 70°C for 5h. The mixture was poured into sat. aq. NaHCO₃, extracted with EtOAc and the organic phase was washed with water, brine and dried over MgSO₄. The solid residue was
 5 recrystallised from toluene to give **HR** as a pale yellow solid (2.96 g).

Yield : 49%

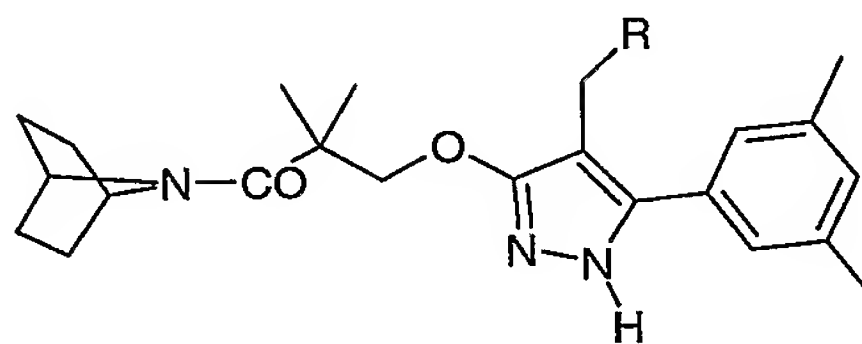
¹H NMR spectrum (DMSO d₆) : 1.24 (s, 6H) ; 1.41 (m, 4H) ; 1.63 (m, 4H) ; 2.29 (s, 6H) ; 4.09 (s, 2H) ; 4.57 (s, 2H) ; 6.08 (s, 1H) 6.97 (s, 1H) ; 7.31 (s, 2H).

MS-ESI : 368 [M+H]⁺

10

Examples 9.1-9.12

The following examples were prepared in a similar manner to Example 9,



H2-13

the table shows the **R** group relating to the above structure, the reaction conditions and
 15 characteristics for each example, corresponding to the description of the preparation of Example 9 given above:-

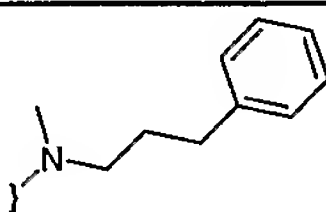
Example 9.1

R	HR mg ; mmol	Formaldehyde ; ml ; mmol	Amine mg ; mmol	Prod. Form	Mass mg ; Yield	MS-ESI
	74 ; 0.20	0.25 ; 3.0	131 ; 0.6	White solid	65 ; 54%	598 [M+H] ⁺

Chromato. – Preparative LC/MS chromatography with H₂O/MeCN buffered with ammonium
 20 carbonate at pH 8.9 (60% H₂O).

¹H NMR spectrum (DMSO d₆) : 1.25 (s, 6H) ; 1.41 (m, 6H) ; 1.53 (m, 2H) ; 1.58 (m, 4H) ; 2.29 (s, 6H) ; 2.3-2.65 (m, 12H) ; 3.01 (s, 2H) ; 4.15 (s, 2H) ; 4.56 (s, 2H) ; 7.00 (s, 1H) ; 7.17 (m, 3H) ; 7.25 (m, 2H) ; 7.44 (s, 2H) ; 11.9 (s br, 1H).

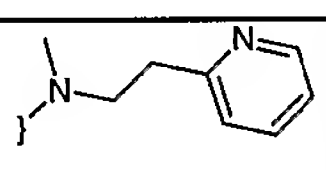
Example 9.2

R	HR mg ; mmol	Formaldehyde ; ml ; mmol	Amine mg ; mmol	Prod. Form	Mass mg ; Yield	MS- ESI
	148 ; 0.40	0.32 ; 4.0	270 ; 2.0	White solid	81 ; 39%	529 [M+ H] ⁺

Chromato. – Preparative LC/MS chromatography with H₂O/MeCN buffered with ammonium carbonate at pH 8.9 (60% H₂O).

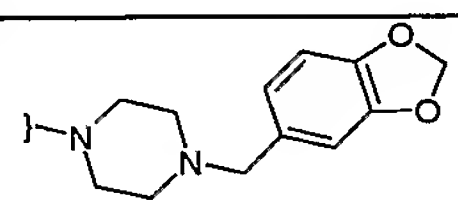
- 5 ¹H NMR spectrum (DMSO d₆) : 1.23(s, 6H) ; 1.41 (m, 4H) ; 1.60 (m, 4H) ; 1.73 (m, 2H) ; 2.1 (s, 3H) ; 2.27 (s, 6H) ; 2.35 (m, 2H) 2.5-2.7 (m, 2H) ; 3.14 (s, 2H) ; 4.14 (s, 2H) ; 4.56 (s, 2H) ; 6.99 (s, 1H) ; 7.12 (m, 3H) ; 7.23 (m, 2H) ; 7.44 (s, 2H) ; 11.9 (s br, 1H).

Example 9.3

R	HR mg ; mmol	Formaldehyde ; ml ; mmol	Amine mg ; mmol	Prod. Form	Mass mg ; Yield	MS- ESI
	80 ; 0.20	0.25 ; 3.0	82 ; 0.6	White solid	27 ; 26%	516 [M+H] +

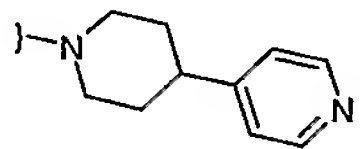
- 10 Chromato. – Preparative LC/MS chromatography with H₂O/MeCN buffered with ammonium carbonate at pH 8.9 (100 to 0% H₂O).

Example 9.4

R	HR mg ; mmol	Formaldehyde ; ml ; mmol	Amine mg ; mmol	Prod. Form	Mass mg ; Yield	MS- ESI
	80 ; 0.20	0.25 ; 3.0	132 ; 0.6	White solid	26 ; 22%	600 [M+H]] ⁺

- 15 Chromato. – Preparative LC/MS chromatography with H₂O/MeCN buffered with ammonium carbonate at pH 8.9 (100 to 0% H₂O).

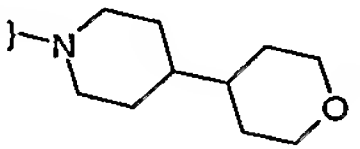
Example 9.5

R	HR mg ; mmol	Formaldehyde ; ml ; mmol	Amine mg ; mmol	Prod. Form	Mass mg ; Yield	MS- ESI
	80 ; 0.20	0.25 ; 3.0	97 ; 0.6	White solid	37 ; 34%	542 [M+H] +

Chromato. – Preparative LC/MS chromatography with H₂O/MeCN buffered with ammonium carbonate at pH 8.9 (100 to 0% H₂O).

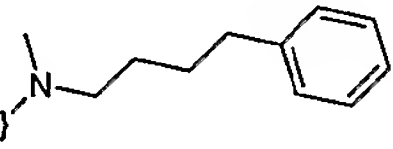
5

Example 9.6

R	HR mg ; mmol	Formaldehyde ; ml ; mmol	Amine mg ; mmol	Prod. Form	Mass mg ; Yield	MS- ESI
	80 ; 0.20	0.25 ; 3.0	102 ; 0.6	White solid	21 ; 19%	549 [M+ H] ⁺

Chromato. – Preparative LC/MS chromatography with H₂O/MeCN buffered with ammonium carbonate at pH 8.9 (100 to 0% H₂O).

10 **Example 9.7**

R	HR mg ; mmol	Formaldehyde ; ml ; mmol	Amine mg ; mmol	Prod. Form	Mass mg ; Yield	MS- ESI
	148 ; 0.40	0.16 ; 2.0	298 ; 2.0	White solid	nd* ; nd*	543 [M+H] +


Chromato. – Preparative LC/MS chromatography with H₂O/MeCN buffered with ammonium carbonate at pH 8.9 (60% H₂O).

¹H NMR spectrum (DMSO d₆) : 1.24 (s, 6H) ; 1.42 (m, 6H) ; 1.54 (m, 2H) ; 1.61 (m, 4H) ;
2.06 (s, 3H) ; 2.25 (s, 6H) ; 2.31 (m, 2H) ; 2.5-2.65 (m, 2H) ; 3.12 (s, 2H) ; 4.16 (s, 2H) ;
4.56 (s, 2H) ; 6.98 (s, 1H) ; 7.13 (m, 3H) ; 7.22 (m, 2H) ; 7.42 (s, 2H) ; 11.9 (s br, 1H).

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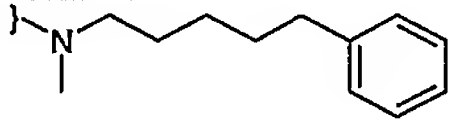
Example 9.8

R	HR mg ; mmol	Formaldehyde ; ml ; mmol	Amine mg ; mmol	Prod. Form	Mass mg ; Yield	MS- ESI
	148 ; 0.40	0.16 ; 2.0	298 ; 2.0	gum	nd* ; nd*	529 [M+H] +

Chromato. – Preparative LC/MS chromatography with H₂O/MeCN buffered with ammonium carbonate at pH 8.9 (60% H₂O).

- 5 ¹H NMR spectrum (DMSO d₆) : 1.24 (s, 6H) ; 1.42 (m, 6H) ; 1.57 (m, 6H) ; 2.28 (s, 6H) ; 2.5-2.6 (m, 4H) ; 3.45 (s, 2H) ; 4.16 (s, 2H) ; 4.55 (s, 2H) ; 6.99 (s, 1H) ; 7.14 (m, 3H) ; 7.25 (m, 2H) ; 7.30 (s, 2H) ; 11.9 (s br, 1H).

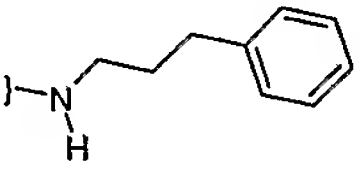
Example 9.9

R	HR mg ; mmol	Formaldehyde ; ml ; mmol	Amine mg ; mmol	Prod. Form	Mass mg ; Yield	MS- ESI
	74 ; 0.20	0.08 ; 1.0	253 ; 1.0	gum	26 ; 24%	543 [M+H] +

- 10 Chromato. – Preparative LC/MS chromatography with H₂O/MeCN buffered with ammonium carbonate at pH 8.9 (80% H₂O).

¹H NMR spectrum (DMSO d₆) : 1.24 (s, 6H) ; 1.29 (m, 2H) ; 1.42 (m, 6H) ; 1.53 (m, 2H) ; 1.57 (m, 4H) ; 2.29 (s, 6H) ; 2.5-2.6 (m, 4H) ; 3.46 (s, 2H) ; 4.16 (s, 2H) ; 4.56 (s, 2H) ; 7.01 (s, 1H) ; 7.15 (m, 3H) ; 7.25 (m, 2H) ; 7.30 (s, 2H) ; 11.9 (s br, 1H).

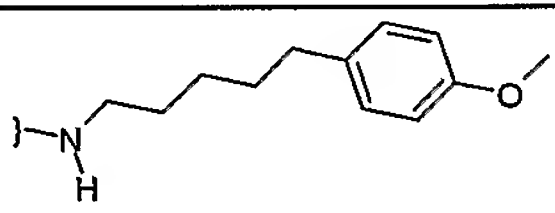
Example 9.10

R	HR mg ; mmol	Formaldehyde ; ml ; mmol	Amine mg ; mmol	Prod. Form	Mass mg ; Yield	MS- ESI
	74 ; 0.20	0.08 ; 1.0	162 ; 1.2	White solid	42 ; 20%	529 [M+H] +

Chromato. – Preparative LC/MS chromatography with H₂O/MeCN buffered with ammonium carbonate at pH 8.9 (80% H₂O).

¹H NMR spectrum (DMSO d₆) : 1.24 (s, 6H) ; 1.41 (m, 4H) ; 1.59 (m, 4H) ; 1.69 (m, 2H) ;
 5 2.29 (s, 6H) ; 2.3-2.65 (m, 4H) ; 3.45 (s, 2H) ; 4.16 (s, 2H) ; 4.56 (s, 2H) ; 7.01 (s, 1H) ; 7.157
 (m, 3H) ; 7.23 (m, 2H) ; 7.31 (s, 2H) ; 11.9 (s br, 1H).

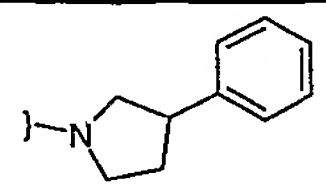
Example 9.11

R	HR mg ; mmol	Formaldehyde ; ml ; mmol	Amine mg ; mmol	Prod. Form	Mass mg ; Yield	MS- ESI
	74 ; 0.20	0.08 ; 1.0	232 ; 1.2	gum	47 ; 41%	573 [M+ H] ⁺

Chromato. – Preparative LC/MS chromatography with H₂O/MeCN buffered with ammonium
 10 carbonate at pH 8.9 (60% H₂O).

¹H NMR spectrum (DMSO d₆) : 1.24 (s, 6H) ; 1.28 (m, 2H) ; 1.41 (m, 6H) ; 1.49 (m, 2H) ;
 1.60 (m, 4H) ; 2.30 (s, 6H) ; 2.3-2.65 (m, xH) ; 3.44 (s, 2H) ; 3.70 (s, 3H) ; 4.16 (s, 2H) ; 4.56
 (s, 2H) ; 6.81 (d, 2H) ; 7.01 (s, 1H) ; 7.04 (d, 2H) ; 7.30 (m, 2H) ; 11.9 (s br, 1H).

15 Example 9.12

R	HR mg ; mmol	Formaldehyde ; ml ; mmol	Amine mg ; mmol	Prod. Form	Mass mg ; Yield	MS- ESI
	74 ; 0.20	0.08 ; 3.0	97 ; 0.6	White solid	74 ; 69%	541 [M+H] +

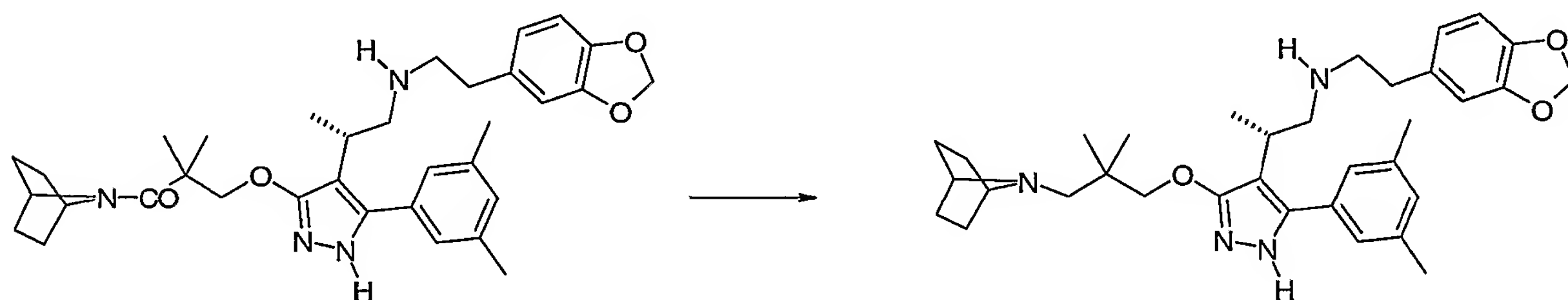
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Chromato. – Preparative LC/MS chromatography with H₂O/MeCN buffered with ammonium carbonate at pH 8.9 (60% H₂O).

¹H NMR spectrum (CDCl₃) : 1.34 (m, 6H) ; 1.45 (m, 5H) ; 1.75 (m, 4H) ; 1.9 (m, 1H) ; 2.31 (m, 1H) ; 2.35 (s, 6H) ; 2.5 (m, 1H) ; 2.59 (m, 2H) ; 2.68 (m, 3H) ; 3.39 (dd, 2H) ; 4.28 (s, 2H) ; 4.65 (s, 2H) ; 7.02 (s, 1H) ; 7.16 (m, 3H) ; 7.25 (m, 2H) ; 7.34 (s, 2H) ; 8.9 (s br, 1H).

Example 10

2-[3-(2,2-dimethyl-3-{azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1H-pyrazol-4-yl]-N-[2-(1,3-benzodioxol-5-yl)ethyl]-(2S)-propylamine



10

C17

Example 10

A solution of **Example 4** (123 mg ; 0.21 mmol) in THF (3 ml) under argon was treated with a solution of LiAlH₄ (420 μ l ; 0.42 mmol ; 1M solution in THF). The mixture was heated at 60°C for 1h. The mixture was treated with an excess of Glaubers' Salt (Na₂SO₄.10H₂O), filtered and evaporated. The residue was purified by flash chromatography eluting with increasingly polar mixtures of MeOH/CH₂Cl₂ (5 to 15% MeOH) to give **Example 10** as a white solid (80 mg).

Yield : 68%

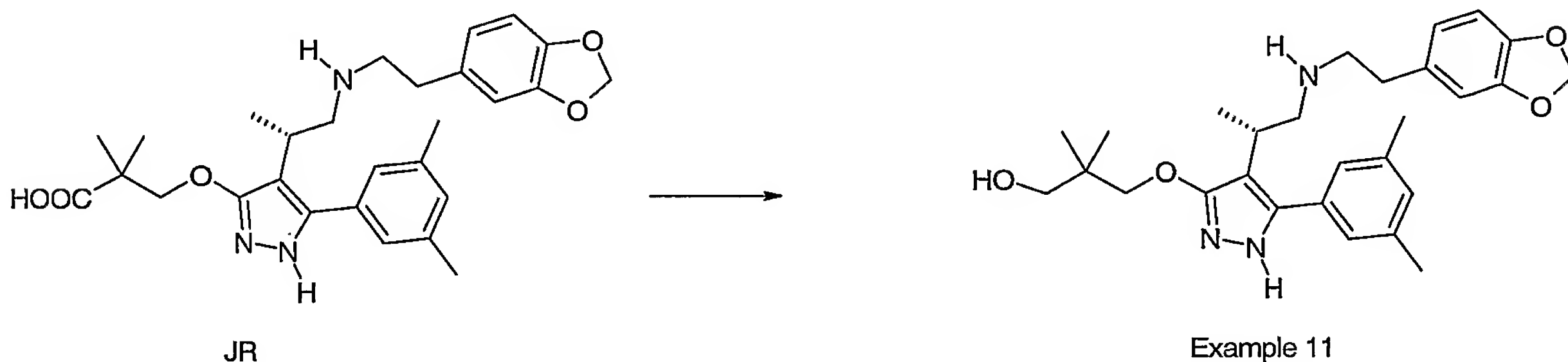
¹H NMR spectrum (DMSO d₆) : 0.93 (s, 6H) ; 1.18 (d, 3H) ; 1.2 (m, 4H) ; 1.59 (m, 4H) ; 2.19 (s, 2H) ; 2.3 (s, 6H) ; 2.55-2.95 (m, 7H) ; 3.07 (s, 2H) ; 3.86 (s, 2H) ; 5.94 (s, 2H) ; 6.53 (d, 1H) ; 6.66 (s, 1H) ; 6.74 (d, 1H) ; 7.04 (s, 1H) ; 7.05 (s, 2H) ; 11.7 (s br 1H).

MS-ESI : 559 [M+H]⁺

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Example 11

2-[3-(2,2-dimethyl-3-hydroxypropoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-(1,3-benzodioxol-5-yl)ethyl]-(2*S*)-propylamine



5 A solution of **JR** (109 mg ; 0.17 mmol) in THF (2 ml) under argon was treated with a solution of LiAlH_4 (350 μl ; 0.35 mmol ; 1M solution in THF). The mixture was heated at 60°C for 1h. The mixture was treated with an excess of Glaubers Salt ($\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$), filtered and evaporated. The residue was purified by flash chromatography eluting with increasingly polar mixtures of MeOH/ CH_2Cl_2 (0 to 15% MeOH) to give **Example 11** as a white solid (68 mg).

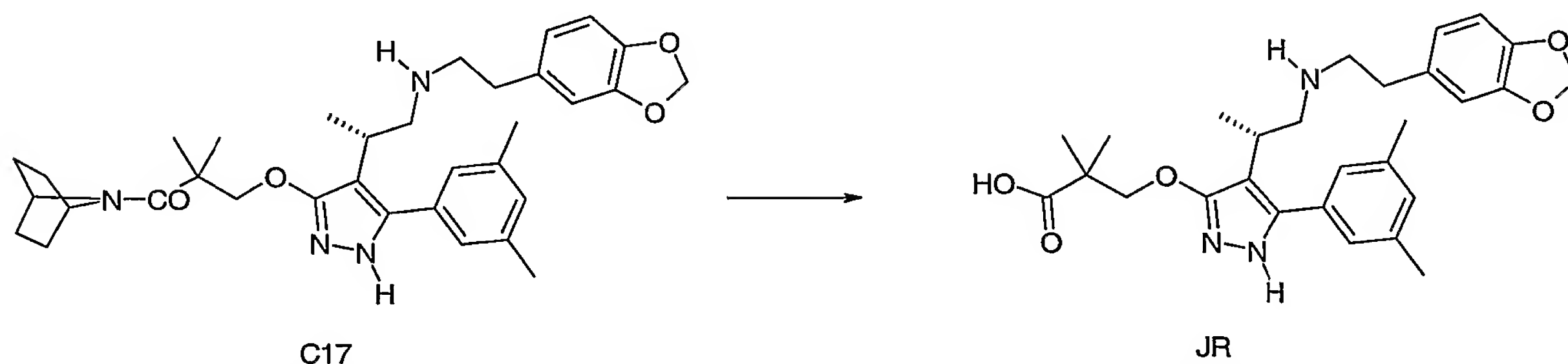
10 Yield : 84%

^1H NMR spectrum ($\text{DMSO}-d_6$) : 0.92 (s, 6H) ; 1.17 (d, 3H) ; 2.3 (s, 6H) ; 2.5-2.9 (m, 7H) ; 3.27 (s, 2H) ; 3.86 (s, 2H) ; 4.61 (t br, 1H) ; 5.94 (s, 2H) ; 6.53 (d, 1H) ; 6.67 (s, 1H) ; 6.74 (d, 1H) ; 7.03 (s, 1H) ; 7.04 (s, 2H) ; 11.7 (s br 1H).

MS-ESI : 480 $[\text{M}+\text{H}]^+$

15

Starting material **JR** was prepared as follows:-



A solution of **Example 4** (205 mg ; 0.35 mmol) in acetonitrile (2 ml) was treated with c.HCl (1 ml) and the mixture was stirred at room temperature for 2h. The mixture was concentrated, extrated with CH_2Cl_2 and the organic phase was washed with water, brine and dried over MgSO_4 . The residue **JR** was obtained as a yellow solid (218 mg). It was used directly in the final step of the synthesis of **Example 11** .

Yield : 80%

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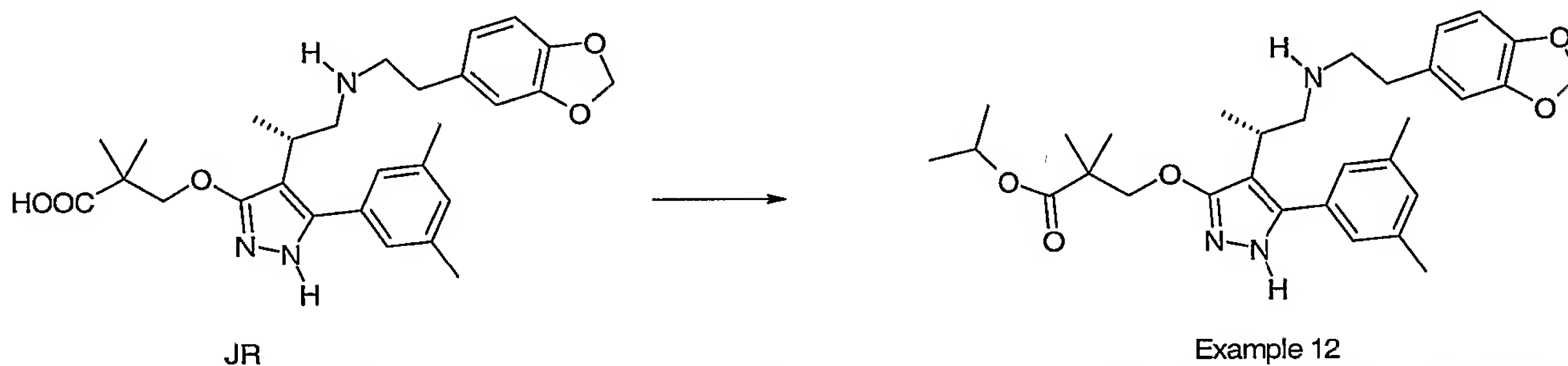
¹H NMR spectrum (DMSO d₆) : 1.24 (m, 9H) ; 2.33 (s, 6H) ; 2.78 (m, 2H) ; 2.95 (m, 2H) ; 3.14 (m, 3H) ; 4.13 (m, 2H) ; 5.98 (s, 2H) ; 6.62 (d, 1H) ; 6.76 (s, 1H) ; 6.84 (d, 1H) ; 7.05 (s, 2H) ; 7.07 (s, 2H) ; 8.6 (s br, 1H) ; 11.7 (s br 1H).

MS-ESI : 494 [M+H]⁺

5

Example 12

2-[3-(2,2-dimethyl-3-oxo3-isopropoxy-propoxy)-5-(3,5-dimethylphenyl)-1H-pyrazol-4-yl]-N-[2-(1,3-benzodioxol-5-yl)ethyl]-(2S)-propylamine



- 10 A solution of **JR** (109 mg ; 0.17 mmol) in CH₂Cl₂ (1 ml) was added to a solution of EDCI (37 mg ; 0.19 mmol) and DMAP (5 mg ; cat.) in iPrOH (5 ml). H₂SO₄ (5 drops ; cat.) was added and the mixture was heated under reflux overnight over molecular sieves. The mixture was concentrated and extracted with CH₂Cl₂/water and the organic phase was washed with water, brine and dried over MgSO₄. The residue was purified by flash chromatography eluting with
- 15 increasingly polar mixtures of MeOH/CH₂Cl₂ (0 to 10% MeOH) to give **Example 12** as a yellow gum (59 mg).

Yield : 65%

- ¹H NMR spectrum (DMSO d₆) : 1.16 (m, 6H) ; 1.24 (m, 9H) ; 2.32 (s, 6H) ; 2.8 (m, 2H) ; 2.95 (m, 2H) ; 3.15 (m, 3H) ; 4.16 (dd, 2H) ; 4.88 (m, 1H) ; 5.98 (s, 2H) ; 6.62 (d, 1H) ; 6.74
- 20 (s, 1H) ; 6.83 (d, 1H) ; 7.04 (s, 2H) ; 7.07 (s, 2H) ; 11.7 (s br 1H).

MS-ESI : 536 [M+H]⁺

THERAPEUTIC USES

- Compounds of Formula (I) are provided as medicaments for antagonising
- 25 gonadotropin releasing hormone (GnRH) activity in a patient, eg, in men and/or women. To this end, a compound of Formula (I) can be provided as part of a pharmaceutical formulation which also includes a pharmaceutically acceptable diluent or carrier (eg, water). The formulation may be in the form of tablets, capsules, granules, powders, syrups, emulsions (eg, lipid emulsions), suppositories, ointments, creams, drops, suspensions (eg, aqueous or oily

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suspensions) or solutions (eg, aqueous or oily solutions). If desired, the formulation may include one or more additional substances independently selected from stabilising agents, wetting agents, emulsifying agents, buffers, lactose, sialic acid, magnesium stearate, terra alba, sucrose, corn starch, talc, gelatin, agar, pectin, peanut oil, olive oil, cacao butter and
5 ethylene glycol.

The compound is preferably orally administered to a patient, but other routes of administration are possible, such as parenteral or rectal administration. For intravenous, subcutaneous or intramuscular administration, the patient may receive a daily dose of 0.1mgkg^{-1} to 30mgkg^{-1} (preferably, 5mgkg^{-1} to 20mgkg^{-1}) of the compound, the compound
10 being administered 1 to 4 times per day. The intravenous, subcutaneous and intramuscular dose may be given by means of a bolus injection. Alternatively, the intravenous dose may be given by continuous infusion over a period of time. Alternatively, the patient may receive a daily oral dose which is approximately equivalent to the daily parenteral dose, the composition being administered 1 to 4 times per day. A suitable pharmaceutical formulation
15 is one suitable for oral administration in unit dosage form, for example as a tablet or capsule, which contains between 10mg and 1g (preferably, 100 mg and 1g) of the compound of the invention.

Buffers, pharmaceutically acceptable co-solvents (eg, polyethylene glycol, propylene glycol, glycerol or EtOH) or complexing agents such as hydroxy-propyl β cyclodextrin may
20 be used to aid formulation.

One aspect of the invention relates to the use of compounds according to the invention for reducing the secretion of LH and/or FSH by the pituitary gland of a patient. In this respect, the reduction may be by way of a reduction in biosynthesis of the LH and FSH and/or a reduction in the release of LH and FSH by the pituitary gland. Thus, compounds according
25 to the invention can be used for therapeutically treating and/or preventing a sex hormone related condition in the patient. By "preventing" we mean reducing the patient's risk of contracting the condition. By "treating" we mean eradicating the condition or reducing its severity in the patient. Examples of sex hormone related conditions are: a sex hormone dependent cancer, benign prostatic hypertrophy, myoma of the uterus, endometriosis,
30 polycystic ovarian disease, uterine fibroids, prostatauxe, myoma uteri, hirsutism and precocious puberty. Examples of sex hormone dependent cancers are: prostatic cancer, uterine cancer, breast cancer and pituitary gonadotrophe adenoma.

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The compounds of the invention may be used in combination with other drugs and therapies used to treat / prevent sex-hormone related conditions.

If formulated as a fixed dose such combination products employ the compounds of this invention within the dosage range described herein and the other pharmaceutically-active agent within its approved dosage range. Sequential use is contemplated when a combination formulation is inappropriate.

In the field of medical oncology examples of such combinations include combinations with the following categories of therapeutic agent:

- i) anti-angiogenic agents (for example linomide, inhibitors of integrin $\alpha v \beta 3$ function, angiostatin, endostatin, razoxin, thalidomide) and including vascular endothelial growth factor (VEGF) receptor tyrosine kinase inhibitors (RTKIs) (for example those described in international patent applications publication nos. WO-97/22596, WO-97/30035, WO-97/32856 and WO-98/13354, the entire disclosure of which documents is incorporated herein by reference);
- ii) cytostatic agents such as anti-oestrogens (for example tamoxifen, toremifene, raloxifene, droloxifene, iodoxifene), progestogens (for example megestrol acetate), aromatase inhibitors (for example anastrozole, letrozole, vorazole, exemestane), anti-progestogens, anti-androgens (for example flutamide, nilutamide, bicalutamide, cyproterone acetate), inhibitors of testosterone 5α -dihydroreductase (for example finasteride), anti-invasion agents (for example metalloproteinase inhibitors like marimastat and inhibitors of urokinase plasminogen activator receptor function) and inhibitors of growth factor function, (such growth factors include for example epidermal growth factor (EGF), platelet derived growth factor and hepatocyte growth factor such inhibitors include growth factor antibodies, growth factor receptor antibodies, tyrosine kinase inhibitors and serine/threonine kinase inhibitors);
- iii) biological response modifiers (for example interferon);
- iv) antibodies (for example edrecolomab); and
- v) anti-proliferative/anti-neoplastic drugs and combinations thereof, as used in medical oncology, such as anti-metabolites (for example anti-folates like methotrexate, fluoropyrimidines like 5-fluorouracil, purine and adenosine analogues, cytosine arabinoside); anti-tumour antibiotics (for example anthracyclines like doxorubicin, daunomycin, epirubicin and idarubicin, mitomycin-C, dactinomycin, mithramycin); platinum derivatives (for example cisplatin, carboplatin); alkylating agents (for example nitrogen mustard, melphalan,

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chlorambucil, busulphan, cyclophosphamide, ifosfamide, nitrosoureas, thiotepa); anti-mitotic agents (for example vinca alkaloids like vincristine and taxoids like taxol, taxotere); enzymes (for example asparaginase); thymidylate synthase inhibitors (for example raltitrexed); topoisomerase inhibitors (for example epipodophyllotoxins like etoposide and teniposide, 5 amsacrine, topotecan, irinotecan).

The compounds of the invention may also be used in combination with surgery or radiotherapy.

ASSAYS

10 The ability of compounds according to the invention to act as antagonists of GnRH can be determined using the following in vitro assays.

Binding Assay Using Rat pituitary GnRH Receptor

The assay is performed as follows:-

1. Incubate crude plasma membranes prepared from rat pituitary tissues in a Tris.HCl buffer 15 (pH. 7.5, 50 mM) containing bovine serum albumin (0.1%), [I-125]D-t-Bu-Ser6-Pro9-ethyl amide-GnRH, and the test compound. Incubation is at 4°C for 90 minutes to 2 hours.
2. Rapidly filter and repeatedly wash through a glass fibre filter.
3. Determine the radioactivity of membrane bound radio-ligands using a gamma counter.

20 From this data, the IC₅₀ of the test compound can be determined as the concentration of the compound required to inhibit radio-ligand binding to GnRH receptors by 50%. Compounds according to the present invention have activity at a concentration from 1nM to 5 µM.

25 Binding Assay Using Human GnRH Receptor

Crude membranes prepared from CHO cells expressing human GnRH receptors are sources for the GnRH receptor. The binding activity of compounds according to the invention can be determined as an IC₅₀ which is the compound concentration required to inhibit the specific binding of [¹²⁵I]buserelin to GnRH receptors by 50%. [¹²⁵I]Buserelin (a peptide 30 GnRH analogue) is used here as a radiolabelled ligand of the receptor.

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Assay to Determine Inhibition of LH release

The LH release assay can be used to demonstrate antagonist activity of compounds, as demonstrated by a reduction in GnRH-induced LH release.

5 Preparation of Pituitary Glands

Pituitary glands obtained from rats are prepared as follows. Suitable rats are Wistar male rats (150-200g) which have been maintained at a constant temperature (eg, 25°C) on a 12 hour light/12 hour dark cycle. The rats are sacrificed by decapitation before the pituitary glands are aseptically removed to tube containing Hank's Balanced Salt Solution (HBSS).

10 The glands are further processed by:-

1. Centrifugation at 250 x g for 5 minutes;
2. Aspiration of the HBSS solution;
3. Transfer of the glands to a petri dish before mincing with a scalpel;
- 15 4. Transfer of the minced tissue to a centrifuge tube by suspending the tissue three successive times in 10 ml aliquots of HBSS containing 0.2% collagenase and 0.2% hyaluronidase;
5. Cell dispersion by gentle stirring of the tissue suspension while the tube is kept in a water bath at 37°C;
- 20 6. Aspiration 20 to 30 times using a pipette, undigested pituitary fragments being allowed to settle for 3 to 5 minutes;
7. Aspiration of the suspended cells followed by centrifugation at 1200 x g for 5 minutes;
8. Re-suspension of the cells in culture medium of DMEM containing 0.37% NaHCO₃, 10% horse serum, 2.5% foetal bovine serum, 1% non essential amino acids, 1% glutamine and
25 0.1% gentamycin;
9. Treatment of the undigested pituitary fragments 3 times with 30 ml aliquots of the collagenase and hyaluronidase;
10. Pooling of the cell suspensions and dilution to a concentration of 3×10^5 cells/ml;
11. Placing of 1.0ml of this suspension in each of a 24 well tray, with the cells being
30 maintained in a humidified 5% CO₂/95% air atmosphere at 37°C for 3 to 4 days

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Testing of Compounds

The test compound is dissolved in DMSO to a final concentration of 0.5% in the incubation medium.

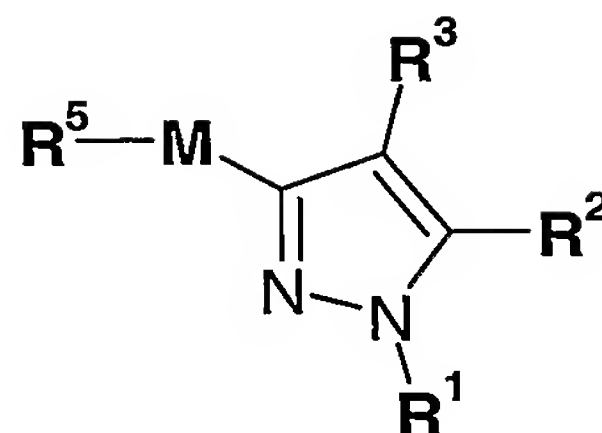
1.5 hours prior to the assay, the cells are washed three times with DMEM containing
5 0.37% NaHCO₃, 10% horse serum, 2.5% foetal bovine serum, 1% non essential amino acids (100X), 1% glutamine (100X), 1% penicillin/streptomycin (10,000 units of each per ml) and 25 mM HEPES at pH 7.4. Immediately prior to the assay, the cells are again washed twice in this medium .

Following this, 1ml of fresh medium containing the test compound and 2nM GnRH is
10 added to two wells. For other test compounds (where it is desired to test more than one compound), these are added to other respective duplicate wells. Incubation is then carried out at 37°C for three hours.

Following incubation, each well is analysed by removing the medium from the well and centrifuging the medium at 2000 x g for 15 minutes to remove any cellular material. The
15 supernatant is removed and assayed for LH content using a double antibody radio-immuno assay. Comparison with a suitable control (no test compound) is used to determine whether the test compound reduces LH release. Compounds according to the present invention have activity at a concentration from 1nM to 5 µM.

CLAIMS:

1. A compound of Formula (I),



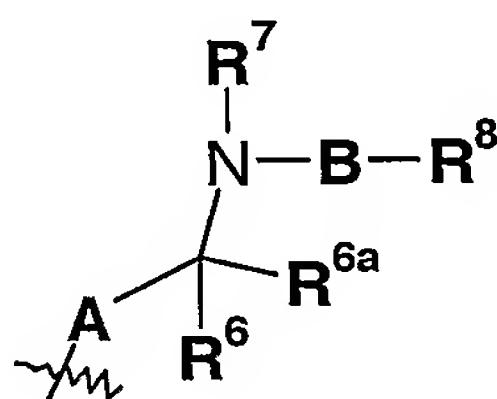
Formula (I)

wherein

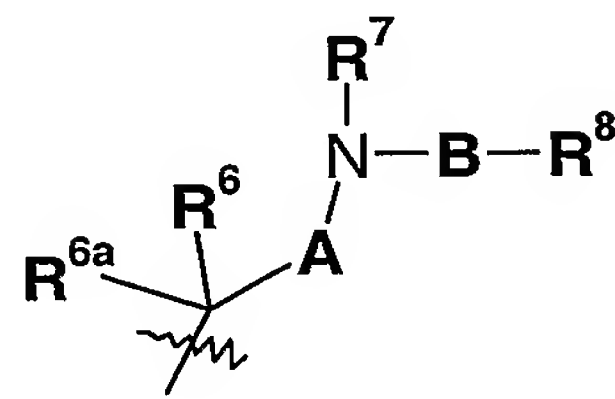
R^1 is selected from: hydrogen, optionally-substituted C_{1-6} alkyl, optionally substituted aryl or optionally-substituted aryl C_{1-6} alkyl;

R^2 is an optionally-substituted mono or bi-cyclic aromatic ring;

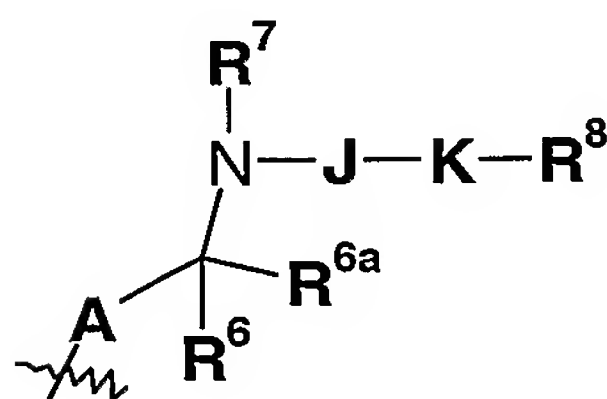
R^3 is selected from a group of Formula (IIa) to Formula (IIf):



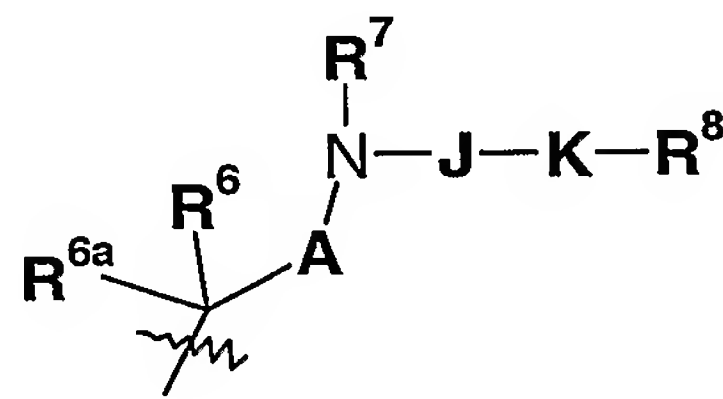
Formula (IIa)



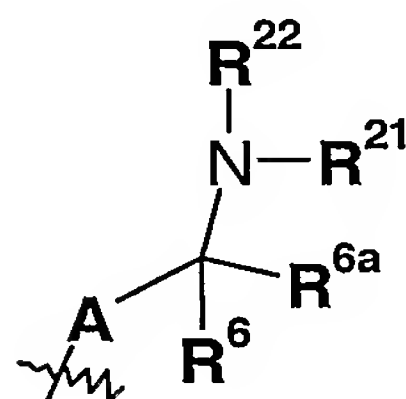
Formula (IIb)



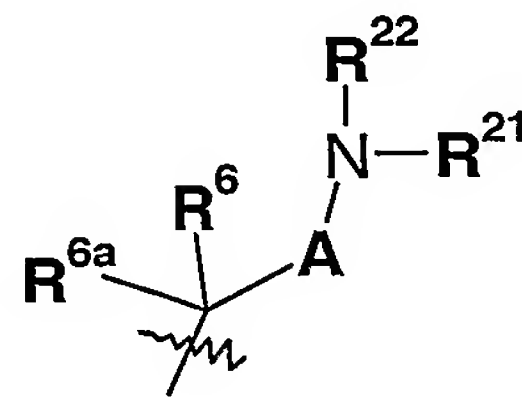
Formula (IIc)



Formula (IId)

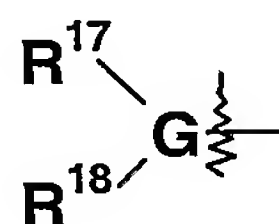


Formula (IIe)



Formula (IIf)

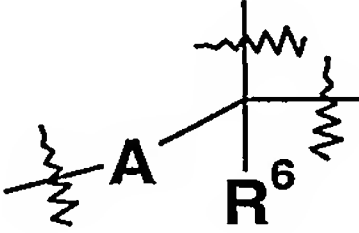
R^5 is a group of Formula (III):

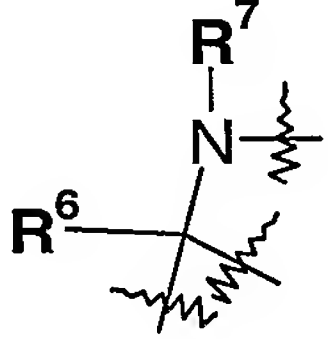


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Formula (III)

R^6 and R^{6a} are independently selected from hydrogen, fluoro, optionally substituted C_{1-6} alkyl, optionally-substituted aryl or optionally substituted aryl C_{1-6} alkyl, or R^6 and R^{6a} taken together and the carbon atom to which they are attached form a carbocyclic ring of 3-7 atoms, or R^6 and R^{6a} taken together and the carbon atom to which they are attached form a carbonyl group;

or when A is not a direct bond the group  forms a carbocyclic ring of 3-7 carbon atoms or a heterocyclic ring containing one or more heteroatoms;

or the group  forms a heterocyclic ring containing 3-7 carbon atoms and one or more heteroatoms;

R^7 is selected from: hydrogen, optionally-substituted C_{1-6} alkyl, optionally-substituted aryl C_{1-6} alkyl, optionally-substituted aryl, optionally substituted heterocyclyl, optionally substituted heterocyclyl C_{1-6} alkyl, R^9OC_{1-6} alkyl-, $R^9R^{10}NC_{1-6}$ alkyl-, $R^9R^{10}NC(O)C_{1-6}$ alkyl-, $-C(NR^9R^{10})=NH$;

or when R^3 is a group of Formula (IIc) or (IId) R^7 is of the formula $-J-K-R^8$;
 R^8 is selected from:

- (i) hydrogen, C_{1-6} alkyl, C_{2-6} alkenyl, C_{2-6} alkynyl, halo C_{1-6} alkyl, C_{1-4} alkoxy C_{1-4} alkyl, hydroxy, hydroxy C_{1-6} alkyl, cyano, N- C_{1-4} alkylamino, N,N-di- C_{1-4} alkylamino, C_{1-6} alkyl- $S(O_n)$ -, $-O-R^b$, $-NR^bR^c$, $-C(O)-R^b$, $-C(O)O-R^b$, $-CONR^bR^c$, $NH-C(O)-R^b$ or $-S(O_n)NR^bR^c$, where R^b and R^c are independently selected from hydrogen and C_{1-4} alkyl optionally substituted with hydroxy, amino, N- C_{1-4} alkylamino, N,N-di- C_{1-4} alkylamino, $HO-C_{2-4}$ alkyl-NH- or $HO-C_{2-4}$ alkyl-N(C_{1-4} alkyl)-;
- (ii) nitro when B is a group of Formula (IV) and X is CH and p is 0;
- (iii) C_{3-7} cycloalkyl, aryl or aryl C_{1-6} alkyl each of which is optionally substituted by R^{12} , R^{13} and R^{14} ;

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(iv) $-(Q)-$ aryl, $-(Q)-$ heterocyclyl, $-(Q)-$ aryl, each of which is optionally substituted by R^{12} , R^{13} and R^{14}

wherein $-(Q)-$ is selected from E, F or a direct bond;

(v) heterocyclyl or heterocyclyl C_{1-6} alkyl each of which is optionally substituted by up to 4 substituents independently selected from R^{12} , R^{13} and R^{14} ;

(vi) a group selected from R^{12} , R^{13} and R^{14} ;

R^9 and R^{10} are independently selected from: hydrogen, hydroxy, optionally substituted C_{1-6} alkyl, optionally substituted aryl, optionally substituted aryl C_{1-6} alkyl, an optionally substituted carbocyclic ring of 3-7 atoms, optionally substituted heterocyclyl, optionally substituted heterocyclyl C_{1-6} alkyl or R^9 and R^{10} taken together can form an optionally substituted ring of 3-9 atoms or R^9 and R^{10} taken together with the carbon atom to which they are attached form a carbonyl group;

R^{11} is selected from: hydrogen, optionally substituted C_{1-6} alkyl, or $N(R^9R^{10})$;

R^{12} is selected from: hydrogen, hydroxy, $R^{17}R^{18}N(CH_2)_{cc}-$, $R^{17}R^{18}NC(O)(CH_2)_{cc}-$, optionally substituted C_{1-6} alkyl- $C(O)N(R^9)(CH_2)_{cc}-$, optionally substituted C_{1-6} alkyl- $SO_2N(R^9)-$, optionally substituted aryl- $SO_2N(R^9)-$, C_{1-3} perfluoroalkyl- $SO_2N(R^9)-$; optionally substituted C_{1-6} alkyl- $N(R^9)SO_2-$, optionally substituted aryl- $N(R^9)SO_2-$, C_{1-3} perfluoroalkyl- $N(R^9)SO_2-$ optionally substituted C_{1-6} alkanoyl- $N(R^9)SO_2-$; optionally substituted aryl- $C(O)N(R^9)SO_2-$, optionally substituted C_{1-6} alkyl- $S(O_n)-$, optionally substituted aryl- $S(O_n)-$, C_{1-3} perfluoroalkyl-, C_{1-3} perfluoroalkoxy, optionally substituted C_{1-6} alkoxy, carboxy, halo, nitro or cyano;

R^{13} and R^{14} are independently selected from: hydrogen, hydroxy, oxo, optionally substituted C_{1-6} alkyl, optionally substituted C_{1-6} alkanoyl, optionally substituted C_{2-6} alkenyl, cyano, nitro, C_{1-3} perfluoroalkyl-, C_{1-3} perfluoroalkoxy, optionally substituted aryl, optionally substituted aryl C_{1-6} alkyl, $R^9O(CH_2)_s-$, $R^9(O)O(CH_2)_s-$, $R^9OC(O)(CH_2)_s-$, $R^{16}S(O_n)(CH_2)_s-$, $R^9R^{10}NC(O)(CH_2)_s-$ or halo;

R^{15} is selected from: hydrogen, optionally substituted C_{1-6} alkyl, $R^{19}OC(O)-$, $R^9R^{10}NC(O)-$, $R^9C(O)-$, $R^9S(O_n)-$;

R^{16} is selected from: hydrogen, C_{1-6} alkyl, C_{1-3} perfluoroalkyl or optionally-substituted aryl;

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R^{17} is independently selected from: hydrogen, hydroxy, cyano or optionally substituted C_{1-6} alkyl;

R^{18} is a group of formula $R^{18a}-C(R^9R^{10})_{0-1}$ - wherein R^{18a} is selected from:

5 $R^{19}OC(O)-$, $R^9R^{10}NC(O)-$, $R^9R^{10}N-$, $R^9C(O)-$, $R^9C(O)N(R^{10})-$, $R^9R^{10}NC(O)-$,
 $R^9R^{10}NC(O)N(R^{10})-$, $R^9SO_2N(R^{10})-$, $R^9R^{10}NSO_2N(R^{10})-$, $R^9C(O)O-$, $R^9OC(O)-$,
 $R^9R^{10}NC(O)O-$, R^9O- , $R^9S(O_n)-$, $R^9R^{10}NS(O_n)-$, hydrogen, optionally substituted
 C_{1-6} alkyl, optionally substituted heterocyclyl;
 or R^{17} and R^{18} when taken together form an optionally substituted carbocyclic
 ring of 3-7 atoms or optionally substituted heterocyclyl;

10 R^{19} is selected from: hydrogen, optionally substituted C_{1-6} alkyl, optionally substituted
 aryl, optionally substituted aryl C_{1-6} alkyl, optionally substituted C_{3-7} cycloalkyl,
 optionally substituted heterocyclyl or optionally substituted heterocyclyl C_{1-6} alkyl;

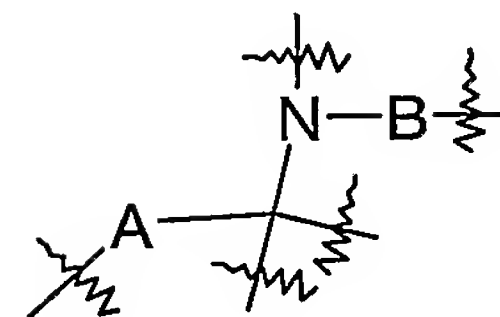
R^{21} and R^{22} are independently selected from hydrogen, optionally substituted
 C_{1-6} alkyl, optionally substituted C_{3-7} cycloalkyl, optionally substituted
 15 heterocyclyl, optionally substituted heterocyclyl C_{1-6} alkyl, optionally substituted
 C_{3-6} alkenyl, optionally substituted C_{3-6} alkynyl, $-(C_{1-5}alkyl)_{aa}-S(O_n)-(C_{1-5}alkyl)_{bb}-$;
 $R^9R^{10}NC_{2-6}alkyl$, $R^9OC_{2-6}alkyl$ or $R^9R^{10}NC(O)C_{2-6}alkyl$, with the proviso that R^9
 and R^{10} independently or taken together are not optionally substituted aryl or
 optionally substituted aryl C_{1-6} alkyl; or

20 R^{21} and R^{22} taken together form an optionally substituted non-aromatic heterocyclic
 ring;

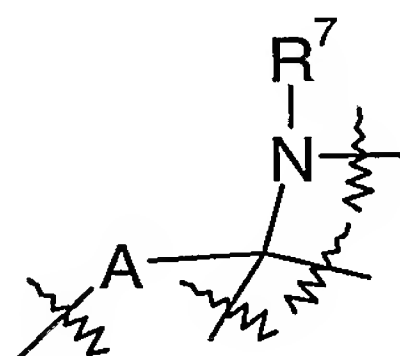
A is selected from:

- (i) a direct bond;
- (ii) optionally-substituted C_{1-5} alkylene wherein the optional substituents are
 25 independently selected from: optionally-substituted C_{1-6} alkyl
 optionally-substituted aryl or optionally substituted aryl C_{1-6} alkyl;
- (iii) a carbocyclic ring of 3-7 atoms;
- (iv) a carbonyl group or $-C(O)-C(R^dR^d)-$, wherein R^d is independently selected
 from hydrogen and C_{1-2} alkyl;

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or when R^3 is a group of Formula (IIa) or (IIb), the group forms a heterocyclic ring containing 3-7 carbon atoms and one or more heteroatoms;
or when R^3 is a group of Formula (IIa), (IIb), (IIc) or (IId), the group

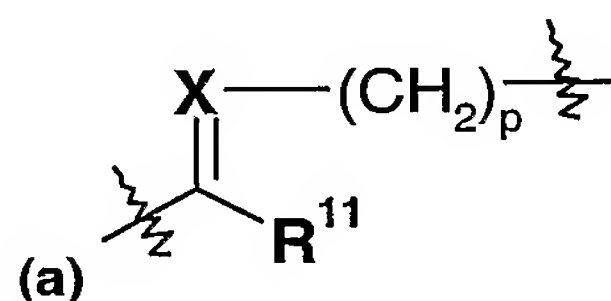


forms a heterocyclic ring containing 3-7 carbon atoms and one

5 or more heteroatoms;

B is selected from:

- (i) a direct bond;
- (ii) a group of Formula (IV)



10 Formula (IV)

wherein:

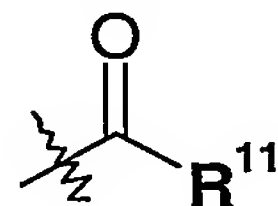
X is selected from N or CH,

wherein at position (a) Formula (IV) is attached to the nitrogen atom and the $(CH_2)_p$ group is attached to R^8 ; and

- 15 (iii) a group independently selected from: optionally substituted C_{1-6} alkylene, optionally substitute C_{3-7} cycloalkyl, optionally substituted C_{3-6} alkenylene, optionally substituted C_{3-6} alkynyl, C_{1-6} alkoxy, $(C_{1-5}alkyl)_{aa}-S(O_n)-(C_{1-5}alkyl)_{bb}-$, $(C_{1-5}alkyl)_{aa}-O-(C_{1-5}alkyl)_{bb}-$, $-(C_{1-5}alkyl)_{aa}-C(O)-(C_{1-5}alkyl)_{bb}-$ or $(C_{1-5}alkyl)_{aa}-N(R^{15})-(C_{1-5}alkyl)_{bb}$,
20 wherein R^{15} and the $(C_{1-5}alkyl)_{aa}$ or $(C_{1-5}alkyl)_{bb}$ chain can be joined to form a ring, wherein the combined length of $(C_{1-5}alkyl)_{aa}$ and $(C_{1-5}alkyl)_{bb}$ is less than or equal to C_5 alkyl;

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or the group $-\mathbf{B}-\mathbf{R}^8$ represents a group of Formula (V)



Formula (V);

or the group together forms an optionally substituted heterocyclic ring
5 containing 4-7 carbon atoms;

or the group forms a heterocyclic ring containing 3-7 carbon atoms
and one or more heteroatoms;

E is $-\text{O}-$, $-\text{S}(\text{O}_n)-$, $-\text{C}(\text{O})-$, $-\text{NR}^{15}-$ or $-\text{C}(\mathbf{R}^9\mathbf{R}^{10})_q-$;

F is $-\mathbf{E}(\text{CH}_2)_r-$;

10 **G** is selected from: hydrogen, halo, N, O, $\text{S}(\text{O}_n)$, $\text{C}(\text{O})$, $\text{C}(\mathbf{R}^9\mathbf{R}^{10})_t$, optionally substituted C_{2-6} alkenylene, optionally substituted C_{2-6} alkynylene or a direct bond to \mathbf{R}^{18} ,

J is a group of the formula: $-(\text{CH}_2)_s-\mathbf{L}-(\text{CH}_2)_s-$ wherein when s is greater than 0, the alkylene group is optionally substituted,

15 or the group together forms an optionally substituted heterocyclic ring containing 4-7 carbon atoms;

K is selected from: a direct bond, $-(\text{CH}_2)_{s1}-$, $-(\text{CH}_2)_{s1}-\text{O}-(\text{CH}_2)_{s2}-$,
 $-(\text{CH}_2)_{s1}\text{C}(\text{O})-(\text{CH}_2)_{s2}-$, $-(\text{CH}_2)_{s1}\text{S}(\text{O}_n)-(\text{CH}_2)_{s2}-$, $-(\text{CH}_2)_{s1}\text{N}(\mathbf{R}^{18})-(\text{CH}_2)_{s2}-$,
 $-(\text{CH}_2)_{s1}-\text{C}(\text{O})\text{N}(\mathbf{R}^9)-(\text{CH}_2)_{s2}-$, $-(\text{CH}_2)_{s1}-\text{N}(\mathbf{R}^9)\text{C}(\text{O})-(\text{CH}_2)_{s2}-$,
 20 $-(\text{CH}_2)_{s1}-\text{N}(\mathbf{R}^9)\text{C}(\text{O})\text{N}(\mathbf{R}^9)-(\text{CH}_2)_{s2}-$, $-(\text{CH}_2)_{s1}-\text{OC}(\text{O})-(\text{CH}_2)_{s2}-$,
 $-(\text{CH}_2)_{s1}-\text{C}(\text{O})\text{O}-(\text{CH}_2)_{s2}-$, $-(\text{CH}_2)_{s1}-\text{N}(\mathbf{R}^9)\text{C}(\text{O})\text{O}-(\text{CH}_2)_{s2}-$,
 $-(\text{CH}_2)_{s1}-\text{OC}(\text{O})\text{N}(\mathbf{R}^9)-(\text{CH}_2)_{s2}-$, $-(\text{CH}_2)_{s1}-\text{OS}(\text{O}_n)-(\text{CH}_2)_{s2}-$, or
 $-(\text{CH}_2)_{s1}-\text{S}(\text{O}_n)-\text{O}-(\text{CH}_2)_{s2}-$, $-(\text{CH}_2)_{s1}-\text{S}(\text{O})_2\text{N}(\mathbf{R}^9)-(\text{CH}_2)_{s2}-$,
 $-(\text{CH}_2)_{s1}-\text{N}(\mathbf{R}^9)\text{S}(\text{O})_2-(\text{CH}_2)_{s2}-$; wherein the $-(\text{CH}_2)_{s1}-$ and $-(\text{CH}_2)_{s2}-$ groups are
 25 independently optionally substituted by hydroxy or C_{1-4} alkyl;

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L is selected from optionally substituted aryl or optionally substituted heterocyclyl;

M is selected from $-(\text{CH}_2)_{0-2}-\text{O}-$ or $-\text{C}(\text{O})\text{NH}-$;

n is an integer from 0 to 2;

p is an integer from 0 to 4;

5 **q** is an integer from 0 to 4;

r is an integer from 0 to 4;

s is an integer from 0 to 4;

s1 and **s2** are independently selected from an integer from 0 to 4, and

s1+s2 is less than or equal to 4;

10 **t** is an integer from 0 to 4;

aa and **bb** are independently 0 or 1; and

cc is an integer between 0 to 2;

with the proviso that

(i) when **G** is hydrogen or halo, then **R¹⁷** and **R¹⁸** are both absent;

15 (ii) when **G** is O, S(O_n), C(O) or C(**R¹¹R¹²**)_t then **G** is substituted by a single group independently selected from the definition of **R¹⁷** or **R¹⁸** and when **G** is a direct bond to **R¹⁸** then **G** is substituted by a single group selected from **R¹⁸**;

(iii) when **R³** is a group of Formula (IIb), **B** is a group of Formula (IV), **R⁸** is selected from group (i) or (ii) above, **R¹¹** is a group of the formula N(**R¹⁰R¹¹**) and **R¹**, **R²** and **R⁵** are as defined above then **R⁴** cannot be hydrogen;

20 (iv) **R³** cannot be unsubstituted pyridyl or unsubstituted pyrimidinyl; and

(v) when **R³** is pyrazolyl substituted by phenyl or pyrazolyl substituted by phenyl and acetyl, **R⁵-M** is hydroxyl or acetyloxy, **R²** is unsubstituted phenyl, then **R¹** cannot be hydrogen or acetyl;

25 or a salt, pro-drug or solvate thereof.

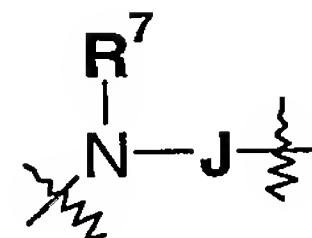
2. A compound according to Claim 1 wherein **R¹** is hydrogen.

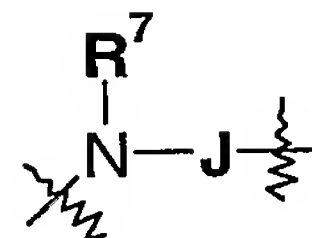
3. A compound according to Claim 1 or Claim 2 wherein **R³** is selected from a group of
30 Formula (IIa) or Formula (IIb).

4. A compound according to Claim 3 wherein **B** is optionally substituted C₁₋₆alkylene.

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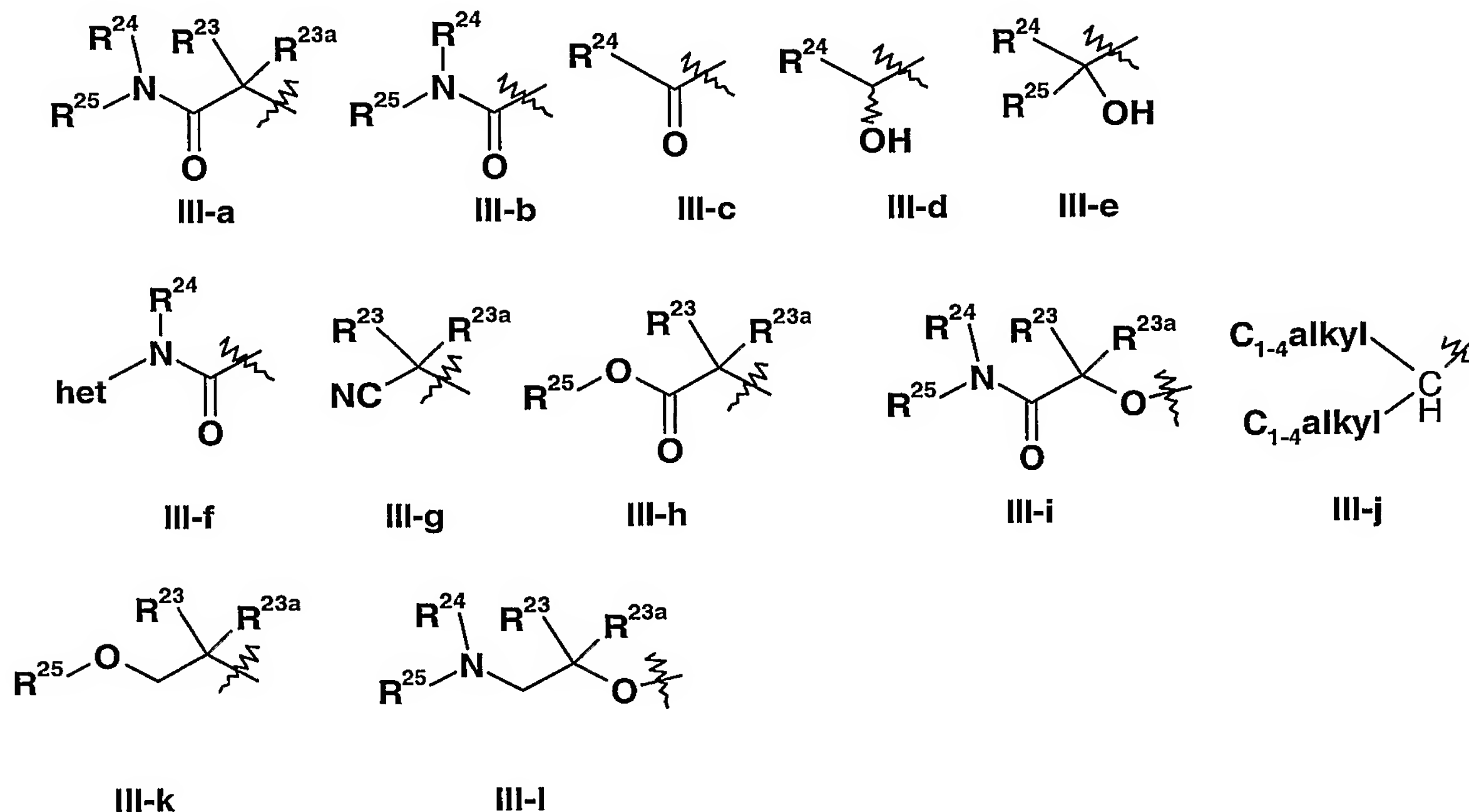
5. A compound according to Claim 1 or Claim 2 wherein R^3 is selected from a group of Formula (IIc) or Formula (IId).



6. A compound according to Claim 5 wherein the group  together forms an optionally substituted heterocyclic ring containing 4-7 carbons atoms
7. A compound according to Claim 6 wherein K is selected from: $-(CH_2)_s-$, $-(CH_2)_s-O-(CH_2)_s-$, $-(CH_2)_s-C(O)-(CH_2)_s-$, $-(CH_2)_s-N(R^{18})-(CH_2)_s-$, $-(CH_2)_s-C(O)N(R^{18})-(CH_2)_s-$, $-(CH_2)_s-N(R^{18})C(O)-(CH_2)_s-$, $-(CH_2)_s-S(O)_2N(R^{18})-(CH_2)_s-$, or $-(CH_2)_s-NHS(O)_2-(CH_2)_s-$.
8. A compound according to any one of Claims 3, 4, 5, 6 or 7 wherein R^8 is selected from:
- (i) hydrogen, C_{1-6} alkyl, C_{2-6} alkenyl, halo C_{1-6} alkyl, hydroxy, cyano, C_{1-6} alkyl $S(O)_n-$, $-O-R^b$, C_{1-4} alkoxy C_{1-4} alkyl, $-C(O)-R^b$, $C(O)O-R^b$, $-NH-C(O)-R^b$, N,N -di- C_{1-4} alkylamino, $-S(O)_nNR^bR^c$ where R^b and R^c are independently selected from hydrogen and C_{1-6} alkyl, and n is 0, 1 or 2;
- (ii) $-(Q)$ -aryl, optionally substituted by up to 3 groups selected from R^{12} , R^{13} and R^{14} ;
- (iii) C_{4-7} heterocyclyl, optionally substituted by up to 3 groups selected from R^{12} , R^{13} and R^{14} , or
- (iv) C_{3-7} carbocyclyl, optionally substituted by up to 3 groups selected from R^{12} , R^{13} and R^{14} ;

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9. A compound according to any one of the preceding claims wherein R^5 is a group of Formula (III) wherein the group of Formula (III) is selected from any one of **III-a** to **III-l**;



5 wherein:

het represents an optionally substituted 3- to 8- membered heterocyclic ring containing from 1 to 4 heteroatoms independently selected from O, N and S;

R^{23} and R^{23a} are independently selected from hydrogen, fluoro or optionally substituted C_{1-8} alkyl; or R^{23} and R^{23a} together with the carbon to which they are attached form an optionally substituted 3 to 7-membered cycloalkyl ring

R^{24} is selected from hydrogen, optionally substituted C_{1-8} alkyl, optionally substituted aryl, $-R^d$ -Ar, where R^d represents C_{1-8} alkylene and Ar represents optionally substituted aryl, and optionally substituted 3- to 8- membered heterocyclic ring optionally containing from 1 to 3 further heteroatoms independently selected from O, N and S;

R^{25} is selected from hydrogen; optionally substituted C_{1-8} alkyl and optionally substituted aryl;

or where the group of Formula (III) represents a group of Formula **III-a**, **III-b** or **III-i**, then the group $NR^{24}(-R^{25})$ represents an optionally substituted 3- to 8-membered heterocyclic ring optionally containing from 1 to 3 further heteroatoms independently selected from O, N and S;

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or where the group of Formula (III) represents structure **III-e**, **R²⁴** and **R²⁵** together with the carbon to which they are attached represents an optionally substituted 3- to 8- membered heterocyclic ring optionally containing from 1 to 4 heteroatoms independently selected from O, N and S;

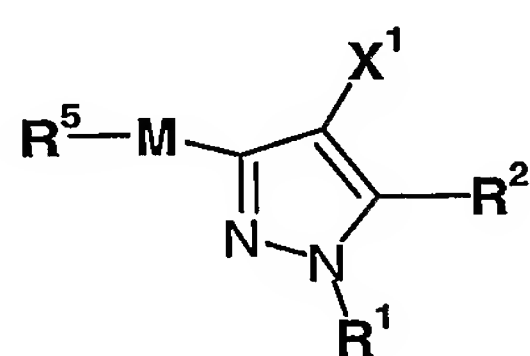
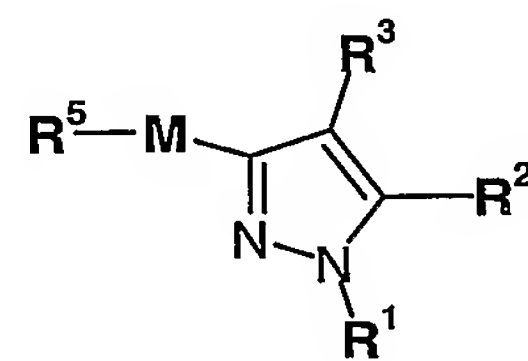
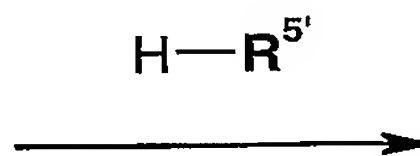
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10. A compound according to any one of the preceding claims wherein **R²** is selected from an optionally substituted monocyclic aromatic ring structure wherein the optional substituents are selected from cyano, **NR^eR^f**, optionally substituted C₁₋₈alkyl, optionally substituted C₁₋₈alkoxy or halo wherein **R^e** and **R^f** are independently selected from
- 10 hydrogen, C₁₋₆alkyl or aryl.
11. A compound selected from:
- 2-[3-(2,2-dimethyl-3-oxo-3-{ azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-(1,3-benzodioxol-5-yl)ethyl]-(2*S*)-propylamine;
- 15 2-[3-(2,2-dimethyl-3-oxo-3-{ azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-pyrid-4-ylethyl]-(2*S*)-propylamine;
- 2-[3-(2,2-dimethyl-3-oxo-3-{ azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-pyrid-4-ylbutyl]-(2*S*)-propylamine;
- 20 2-[3-(2,2-dimethyl-3-oxo-3-{ azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[4-(4-methoxyphenyl)butyl]-(2*S*)-propylamine;
- 2-[3-(2,2-dimethyl-3-oxo-3-{ azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-(43-trifluoromethylphenyl)ethyl]-(2*S*)-propylamine;
- 25 2-[3-(2,2-dimethyl-3-oxo-3-{ azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-(4-fluorophenyl)ethyl]-(2*S*)-propylamine;
- 2-[3-(2,2-dimethyl-3-oxo-3-{ azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-(3-methoxyphenyl)ethyl]-(2*S*)-propylamine;
- 30 2-[3-(2,2-dimethyl-3-oxo-3-{ azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-(4-methoxyphenyl)ethyl]-(2*S*)-propylamine;

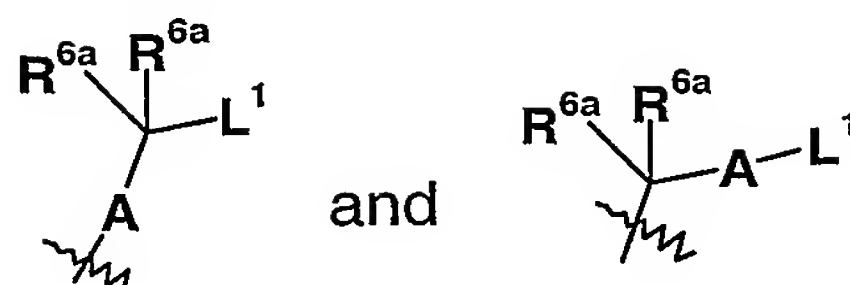
- 152 -

2-[3-(2,2-dimethyl-3-oxo-3-{azabicyclo[2.2.1]heptan-7-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-(4-methylsulphonylamino-phenyl)ethyl]-(2*S*)-propylamine; and
 2-[3-(2,2-dimethyl-3-oxo-3-{azabicyclo[2.2.2]oct-2-yl}propoxy)-5-(3,5-dimethylphenyl)-1*H*-pyrazol-4-yl]-*N*-[2-(1,3-benzodioxol-5-yl)ethyl]-(2*S*)-propylamine;
 or a salt, pro-drug or solvate thereof.

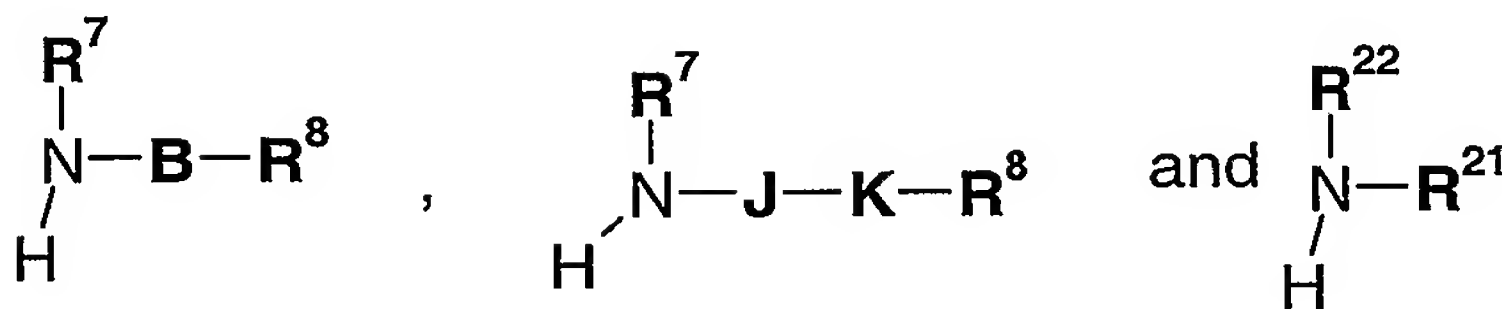
12. A compound, or salt, pro-drug or solvate thereof, according to any one of Claims 1 to 11 for use as a medicament.
13. A pharmaceutical formulation comprising a compound, or salt, pro-drug or solvate thereof, according to any one of Claims 1 to 11 and a pharmaceutically acceptable diluent or carrier.
14. Use of a compound, or salt, pro-drug or solvate thereof, according to any one of Claims 1 to 11, in the manufacture of a medicament for antagonising gonadotropin releasing hormone activity.
15. Use of a compound, or salt, pro-drug or solvate thereof, according to any one of Claims 1 to 11, in the manufacture of a medicament for administration to a patient, for therapeutically treating and/or preventing a sex hormone related condition in the patient.
16. A process for the preparation of a compound of Formula (I) as defined in Claim 1, comprising a process selected from (a) to (h) as follows:
- (a) Reaction of a compound of formula **XXXII** with a compound of formula $H-R^{5'}$ to form a compound of Formula (I),

**XXXII****Formula (I)**

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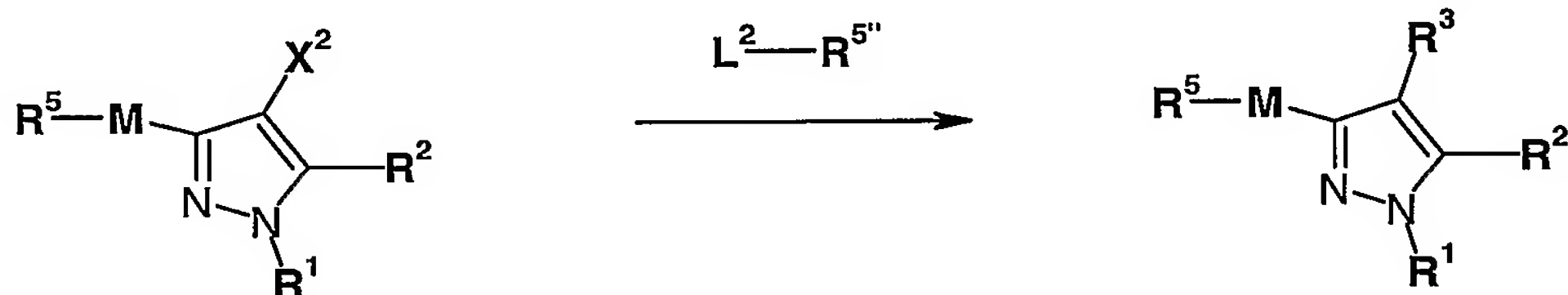
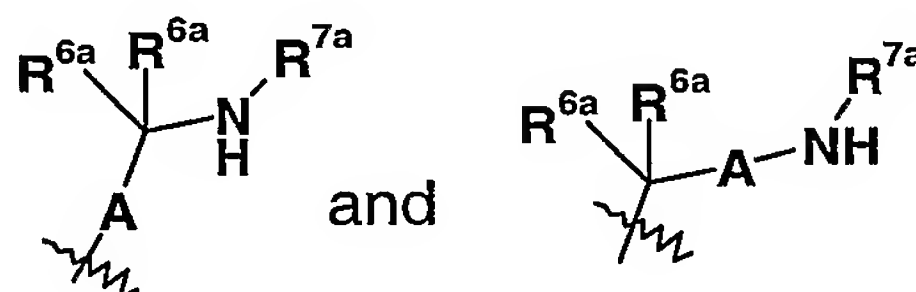


wherein X^1 is selected from: ; L^1 is a displaceable group; and



$H-R^{5'}$ is selected from:

- (b) Reaction of a compound of formula **XXXIII** with a compound of formula $H-R^{5''}$ to form a compound of Formula (I),

**XXXIII****Formula (I)**

wherein X^2 is selected from: ; L^2 is a displaceable group and R^{7a} is selected from the definition of R^7 or R^{22} above, and $L^2-R^{5''}$ is selected from:

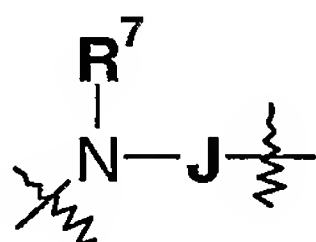


- (c) For compounds of Formula (I) wherein R^3 is a group of Formula (IIa), (IIb), (IIc) or (IId) and R^7 is other than part of a heterocyclic ring or hydrogen, reaction of a compound of Formula (I) wherein R^3 is a group of Formula (IIa), (IIb), (IIc) or (IId) and R^7 is hydrogen with a group of formula L^3-R^{7a} , wherein R^{7a} is as defined above for R^7 with the exclusion of hydrogen and L^3 is a displaceable group;
- (d) For compounds of Formula (I) wherein R^3 is a group of Formula (IIe) or (IIf) and R^{21} is other than hydrogen, reaction of a compound of Formula (I) wherein R^3 is a group of Formula (IIe) or (IIf) and R^{21} is hydrogen with a group of formula L^4-R^{21a} , wherein R^{21a} is as defined above for R^{21} with the exclusion of hydrogen and L^4 is a displaceable group;

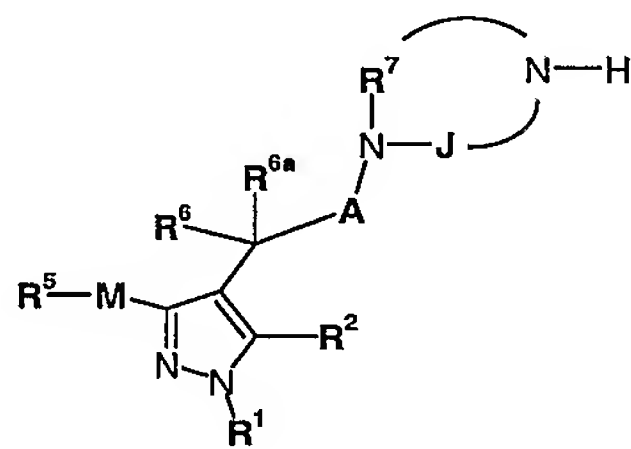
- 154 -

- (e) For compounds of Formula (I) wherein R^3 is a group of Formula (IIe) or (IIf) and R^{22} is other than hydrogen, reaction of a compound of Formula (I) wherein R^3 is a group of Formula (IIe) or (IIf) and R^{22} is hydrogen with a group of formula L^5-R^{22a} , wherein R^{22a} is as defined above for R^{22} with the exclusion of hydrogen and L^5 is a displaceable group;

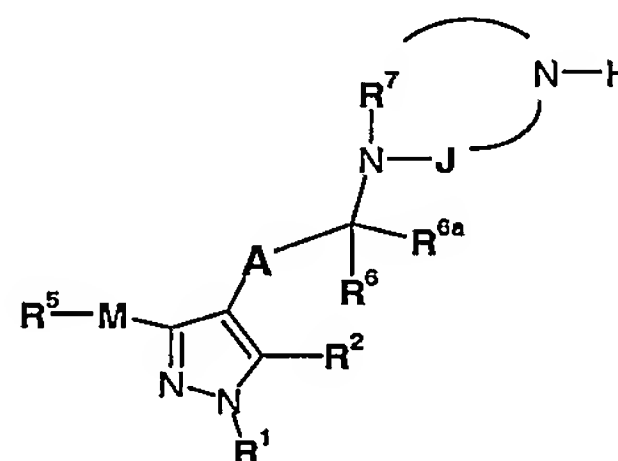
- (f) For compounds of Formula (I) wherein R^3 is a group of Formula (IIc) or (IId) and



the group together forms an optionally substituted nitrogen-containing heterocyclic ring containing 4-7 carbons atoms, reaction of a compound of Formula XXXIVa or XXXIVb, with a compound of Formula L^6-K-R^8 , wherein L^3 is a displaceable group

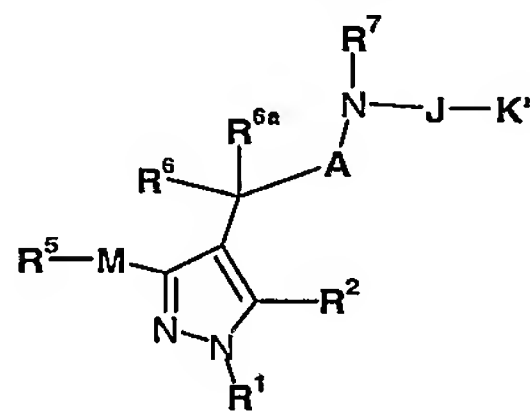


XXXIVa

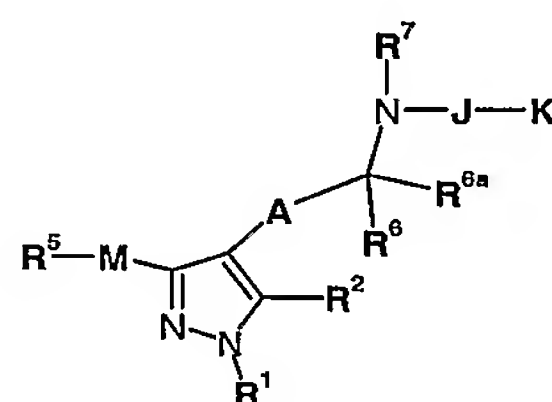


XXXIVb

- (g) For compounds of Formula (I) wherein R^3 is a group of Formula (IIc) or (IId), reaction of a compound of Formula XXXVa or XXXVb, with a compound of Formula $L^7-K''-R^8$, wherein L^7 is a displaceable group, and wherein the groups K' and K'' comprise groups which when reacted together form K ,



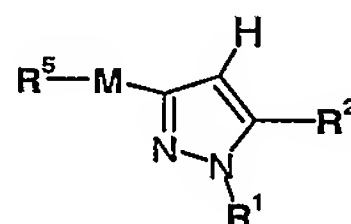
XXXVa



XXXVb

;

- (h) reaction of a compound of Formula XXXVI with a compound of the formula L^8-R^5 , wherein L^8 is a displaceable group



XXXVI

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and thereafter if necessary:

- i) converting a compound of the Formula (I) into another compound of the Formula (I);
- ii) removing any protecting groups;
- iii) forming a salt, pro-drug or solvate.

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
4 March 2004 (04.03.2004)

PCT

(10) International Publication Number
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417/12, 409/12, 491/04, 405/12

Arlette Remia, F-51100 Reims (FR). **MAUDET, Mickael, Louis, Pierre** [FR/FR]; AstraZeneca Reims, Z.I. la Pompelle, BP 1050, F-51689 Reims Cedex 2 (FR).

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(74) Agent: **ASTRAZENECA**; Global Intellectual Property, Mereside, Alderley Park, Macclesfield, Cheshire SK10 4TG (GB).

(22) International Filing Date: 19 August 2003 (19.08.2003)

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(71) Applicant (*for AE, AG, AL, AM, AT, AU, AZ, BA, BB, BE, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CY, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, FR, GB, GD, GE, GH, GM, GR, HR, HU, ID, IE, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, SZ, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW only*): **ASTRAZENECA AB** [SE/SE]; Sodertalje, S-151 85 (SE).

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

(71) Applicant (*for MG only*): **ASTRAZENECA UK LIMITED** [GB/GB]; 15 Stanhope Gate, London, Greater London W1K 1LN (GB).

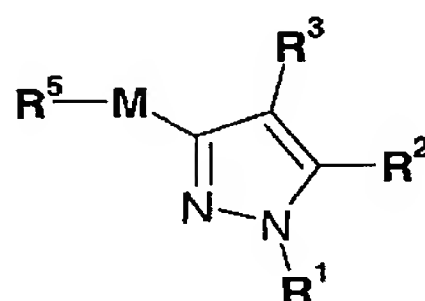
Published:
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(72) Inventors; and
(75) Inventors/Applicants (*for US only*): **BIRD, Thomas, Geoffrey, Colerick** [GB/FR]; AstraZeneca Reims, Z.I. la Pompelle, BP 1050, F-51689 Reims Cedex 2 (FR). **HERDEMANN, Matthias, Ferdinand** [DE/FR]; 16 rue

(88) Date of publication of the international search report:
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: DERIVATIVES OF 3-HYDROXY-4-(CYCLYL-ALKYLAMINOALKYL)-5-PHENYL-1H-PYRAZOLE AS ANTAGONISTS OF THE GONADOTROPIN RELEASING HORMONE (GNRH) FOR USE IN THE TREATMENT OF SEX HORMONE RELATED CONDITIONS, SUCH AS PROSTATIC OF UTERINE CANCER



(I)

(57) Abstract: The invention relates to a group of novel pyrazole compounds of Formula (I): wherein: R¹, R², R³, M and R⁵ are as defined in the specification, which are useful as gonadotrophin releasing hormone antagonists. The invention also relates to pharmaceutical formulations of said compounds, methods of treatment using said compounds and to processes for the preparation of said compounds.



WO 2004/017961 A3

INTERNATIONAL SEARCH REPORT

Internatio ication No
PCT/GB 03/03633

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 A61K31/4155 A61K31/4439 A61K31/4196 A61K31/496 A61K31/5377
A61K31/541 A61K31/506 A61K31/497 A61K31/4725 C07D401/12
C07D231/20 C07D403/12 C07D413/12 C07D417/12 C07D409/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A61K C07D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

WPI Data, EPO-Internal, CHEM ABS Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 00 31072 A (SEARLE & CO (US)) 2 June 2000 (2000-06-02) examples 32-38, 40, 86 formulae IIa, IIb page 1, line 9	1-10, 12, 13, 16
X	WO 00 31063 A (SEARLE & CO (US)) 2 June 2000 (2000-06-02) formula 109, page 206 examples A-440-446, A-448 --- -/-	1-10, 12, 13, 16

☒ Further documents are listed in the continuation of box C.

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- *&* document member of the same patent family

Date of the actual completion of the international search

21 November 2003

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03/02/2004

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Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Cortés, J

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 C07D491/04 C07D405/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>JP 10 287655 A (KAKEN PHARMA CO LTD (JP)) 27 October 1998 (1998-10-27) 5th to 8th compound in 1st row of table on page 5 17th to 19th compound in 2nd row of table on page 6 all compounds in 1st row of table o page 7 1st to 9th and 20th to 24th compound in 2nd row of page 7 compounds 54 and 56, page 16 formula I & PAJ abstract</p> <p style="text-align: center;">--- -/--</p>	<p>1-8,10, 12,13,16</p>

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- * & * document member of the same patent family

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Date of mailing of the international search report

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Name and mailing address of the ISA
European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
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Fax: (+31-70) 340-3016

Authorized officer

Cortés, J

INTERNATIONAL SEARCH REPORT

International
PCT/GB 03/03633

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>DATABASE CA 'Online! CHEMICAL ABSTRACTS SERVICE, COLUMBUS, OHIO, US; O'CALLAGHAN, C. N.: "Synthesis of ethyl 3-oxo-4-pyrazolidinecarboxylates" retrieved from STN Database accession no. 77:61875 XP002261638 abstract & JOURNAL OF THE CHEMICAL SOCIETY, PERKIN TRANSACTIONS 1: ORGANIC AND BIO-ORGANIC CHEMISTRY (1972-1999) (1972), (11), 1416-19 ,</p>	1-10,12, 13,16
X	<p>--- DATABASE CA 'Online! CHEMICAL ABSTRACTS SERVICE, COLUMBUS, OHIO, US; MOHAREB, RAFAT M. ET AL: "The reaction of 2-amino-3-cyano-4,5,6,7-tetrahydrobenzo'b! thiophene with diethyl malonate: synthesis of coumarin, pyridine, and thiazole derivatives" retrieved from STN Database accession no. 135:92599 XP002261639 abstract & HETEROATOM CHEMISTRY (2001), 12(3), 168-175 ,</p>	1-10,12, 13,16
X	<p>--- DATABASE CA 'Online! CHEMICAL ABSTRACTS SERVICE, COLUMBUS, OHIO, US; AFRIDI, A. SULTAN ET AL: "N-Oxides and related compounds. Part 56. Preparation of NN'-linked bi(heteroaryls) from dehydroacetic acid and 2,6-dimethyl-4-pyrone" retrieved from STN Database accession no. 87:201414 XP002261640 abstract & JOURNAL OF THE CHEMICAL SOCIETY, PERKIN TRANSACTIONS 1: ORGANIC AND BIO-ORGANIC CHEMISTRY (1972-1999) (1977), (12), 1428-36 ,</p> <p>--- -/--</p>	1-10,12, 13,16

INTERNATIONAL SEARCH REPORT

Internation cation No
PCT/GB 03/03633

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>DATABASE CA 'Online! CHEMICAL ABSTRACTS SERVICE, COLUMBUS, OHIO, US; MUSTAFA, AHMED ET AL: "Reactions of substituted coumarins, furocoumarins, and khellinonestyryl derivatives with hydrazine and phenylhydrazine" retrieved from STN Database accession no. 65:20701 XP002261641 abstract & JUSTUS LIEBIGS ANNALEN DER CHEMIE (1966), 692, 166-73 ,</p> <p>---</p>	1-10,12, 13,16
A	<p>WO 02 48112 A (ORTHO MCNEIL PHARM INC (US)) 20 June 2002 (2002-06-20) page 1, line 11 - line 13 examples 4-6,8,9</p> <p>---</p>	1-16
A	<p>WO 00 53602 A (MERCK & CO INC (US)) 14 September 2000 (2000-09-14) cited in the application abstract</p> <p>---</p>	1-16
P,X	<p>WO 03 053927 A (TAISHO PHARM (JP)) 3 July 2003 (2003-07-03) compound 92, page 57 & WPI abstract</p> <p>-----</p>	1-10,12, 13,16

INTERNATIONAL SEARCH REPORT

Interr application No.
PCT/GB 03/03633

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☒ Claims Nos.: 1-16 (partly)
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
see FURTHER INFORMATION sheet PCT/ISA/210
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box I.2

Claims Nos.: 1-16 (partly)

The claimed compounds are widely known pharmaceutically active compounds.

The initial phase of the search revealed a very large number of documents relevant to the issue of novelty. So many documents were retrieved that it is impossible to determine which parts of the claims may be said to define subject-matter for which protection might legitimately be sought (Article 6 PCT).

For these reasons, a meaningful search over the whole breadth of the claims is impossible.

Consequently, the search has been restricted to a generic group defined by the structural features of the examples, i.e. to compounds wherein:

R₂ is optionally substituted phenyl,

M is -(CH₂)₀₋₂-O- and

A is one of the options (i) to (iv) in claim 1

The applicant's attention is drawn to the fact that claims, or parts of claims, relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure.

INTERNATIONAL SEARCH REPORT

Information on patent family members

Intern Application No
PCT/GB 03/03633

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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